

UNIVERSITÉ DE MONTRÉAL

DSDM PROJECT

L-1.1 : A PROGRAM FOR BOX-COX TRANSFORMATIONS IN
REGRESSION MODELS WITH HETEROSKEDASTIC
AND AUTOREGRESSIVE RESIDUALS

by

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CENTRE DE RECHERCHE SUR LES TRANSPORTS



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ABSTRACT

L.1.1 is a program designed to deal with the specification of the functional form in the generalized single-equation regression model when the functional form of heteroskedasticity of the residuals, which may also be autocorrelated, is fully analyzed. Fixed or estimated parameters in the Box-Cox transformations can be associated with the dependent and groups of independent variables, which may be simultaneously modified by a chosen autocorrelation structure in which the autoregressive parameters are estimated, and by a selected functional form of heteroskedasticity in which the different parameters can be either fixed or estimated. The asymptotic covariance matrix of all parameter estimates of the system is computed. A number of useful outputs, including elaborate statistics associated with forecasts and plots of the likelihood functions, can also be obtained.

RÉSUMÉ

Le programme L-1.1 est destiné à l'étude de la forme fonctionnelle du modèle de régression multiple lorsque la forme de l'hétéroscédasticité des erreurs, qui peuvent aussi être autocorrélées, doit aussi être analysée en profondeur. Le programme permet de fixer ou d'estimer les paramètres dans les transformations Box-Cox appliquées à la variable dépendante et aux groupes de variables indépendantes, d'estimer conjointement les paramètres d'une structure d'autocorrélation choisie et finalement de fixer ou d'estimer les différents paramètres associés à la forme de l'hétéroscédasticité des erreurs. La matrice de covariance asymptotique des estimations de tous ces paramètres est calculée. La procédure permet aussi de faire un certain nombre de calculs utiles, dont des prévisions et des graphes de la fonction de vraisemblance.

NOTE

The Direct Spatial Demand by Mode (DSDM) research project comprises the development of various new computer-based analytical transportation planning tools. The procedure described here should be used in models in which the *level* of a particular variable is of interest. Other forthcoming procedures will be centered on the analysis of market *shares*.

REMARQUE

Le projet de recherche sur la Demande Spatiale Directe par Mode (DSDM) porte sur le développement de nouveaux outils informatisés de planification et d'analyse des transports. La procédure décrite ici est applicable aux modèles qui expliquent le *niveau* d'une variable. D'autres procédures d'analyse de *parts* de marché sont en voie de développement.



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I. The Likelihood Function

Consider the following model specified by Gaudry and Dagenais (1978) and summarized in Gaudry and Dagenais (1979) :

$$Y_t^{(\lambda_y)} = \sum_k \beta_k X_{kt}^{(\lambda_{xk})} + u_t, \quad (t=1, \dots, n) \quad (1)$$

$$u_t = \sqrt{f(X_t)} v_t, \quad (2)$$

$$v_t = \sum_{\ell=1}^r \rho_\ell v_{t-\ell} + w_t, \quad (3)$$

where $E(v_t^2) = \psi^2$, the r -th autoregressive process is assumed to satisfy standard stationarity assumptions and the w_t are normally and independently distributed with zero mean and covariance matrix $\sigma_w^2 I$.

The functional form for heteroskedasticity is assumed to be :

$$f(X_t) = \begin{cases} \exp \left(\sum_m \delta_m X_{mt}^{(\lambda_{em})} \right) & \text{if } \lambda_u = 0 \\ \left[\lambda_u \left(\delta_0 + \sum_m \delta_m X_{mt}^{(\lambda_{em})} \right) + 1 \right]^{1/\lambda_u} & \text{if } \lambda_u \neq 0 \end{cases} \quad (4)$$

where $y_t^{(\lambda_y)}$, $x_{kt}^{(\lambda_{xk})}$ and $x_{mt}^{(\lambda_{em})}$ are respectively the Box-Cox transforms of y_t , x_{kt} and x_{mt} ; if Z_t denotes y_t , x_{kt} or x_{mt} , the Box-Cox transformation of $Z_t > 0$ is defined for the parameter λ as :

$$Z_t^{(\lambda)} = \begin{cases} \ln Z_t & \text{if } \lambda = 0 \\ (Z_t^\lambda - 1)/\lambda & \text{if } \lambda \neq 0 \end{cases} \quad (5)$$

Note that $f(X_t)$ is in the form of an inverse Box-Cox transformation, and the set of variables X_m may be partly or completely different from the X_k 's group. We will not allow the case $\lambda_u \neq 0$ in this program due to insufficient experience with it so far.

The likelihood function associated with this model, when the first r observations are dropped in order to reduce the considerable computational burden which keeping them would have involved, can be expressed as :

$$L = \prod_{t=1+r}^n \frac{1}{\sigma_w \sqrt{2\pi}} \frac{y_t^{\lambda_y - 1}}{\sqrt{f(X_t)}} \exp \left\{ -\frac{1}{2\sigma_w^2} \left(\frac{u_t}{\sqrt{f(X_t)}} - \sum_{\ell=1}^r \rho_\ell \frac{u_{t-\ell}}{\sqrt{f(X_{t-\ell})}} \right)^2 \right\}, \quad (6)$$

$$\text{where } u_t = y_t^{(\lambda_y)} - \sum_k \beta_k X_{kt}^{(\lambda_x)}.$$

The corresponding log-likelihood function is :

$$\begin{aligned} \text{Log } L = & -\frac{n-r}{2} \ln (2\pi\sigma_w^2) + (\lambda_y - 1) \sum_{t=1+r}^n \ln y_t - \frac{1}{2} \sum_{t=1+r}^n \ln f(X_t) \\ & - \frac{1}{2\sigma_w^2} \sum_{t=1+r}^n \left(\frac{u_t}{\sqrt{f(X_t)}} - \sum_{\ell=1}^r \rho_\ell \frac{u_{t-\ell}}{\sqrt{f(X_{t-\ell})}} \right)^2. \end{aligned} \quad (7)$$

II. The Concentrated Log-likelihood Function

In view of problems involving large numbers of parameters, specially in the fixed part of model (1) — the β_k 's —, the log-likelihood function (7) must be concentrated first on σ_w^2 and then on the β_k 's, in order to reduce the number of parameters directly involved in the maximization of (7) : the remaining parameters to be estimated are ρ , λ_x , λ_y , δ and λ_e , where the underscripts ℓ , k , m are dropped for ρ , λ_x , δ and λ_e to indicate the corresponding column vectors.

Taking the first derivative of (7) with respect to σ_w^2 , yields :

$$\begin{aligned} \frac{\partial \text{Log } L}{\partial \sigma_w^2} &= -\frac{n-r}{2} \frac{1}{\sigma_w^2} + \frac{1}{2\sigma_w^4} \sum_{t=1+r}^n \left(\frac{u_t}{\sqrt{f(X_t)}} - \sum_{\ell=1}^r \rho_\ell \frac{u_{t-\ell}}{\sqrt{f(X_{t-\ell})}} \right)^2 \\ &= \frac{1}{2\sigma_w^2} \left[- (n-r) + \frac{1}{\sigma_w^2} \sum_{t=1+r}^n \left(\frac{u_t}{\sqrt{f(X_t)}} - \sum_{\ell=1}^r \rho_\ell \frac{u_{t-\ell}}{\sqrt{f(X_{t-\ell})}} \right)^2 \right] . \end{aligned} \quad (8)$$

Setting (8) to zero, we solve for σ_w^2 :

$$\hat{\sigma}_w^2 = \frac{1}{\sum_{t=1+r}^n} \left(\frac{u_t}{\sqrt{f(X_t)}} - \sum_{\ell=1}^r \rho_\ell \frac{u_{t-\ell}}{\sqrt{f(X_{t-\ell})}} \right)^2 / (n-r) . \quad (9)$$

Replacing σ_w^2 by its value $\hat{\sigma}_w^2$ in formula (7), we obtain the log-likelihood function concentrated on σ_w^2 :

$$\text{Log } L^* = -\frac{n-r}{2} [1 + \ln(2\pi)] - \frac{n-r}{2} \ln \hat{\sigma}_w^2 + (\lambda_y - 1) \sum_{t=1+r}^n \ln y_t - \frac{1}{2} \sum_{t=1+r}^n \ln (f(x_t)) . \quad (10)$$

To concentrate the function (10) on the β_k 's, we must use matrix notation for the expression in (9), which can be rewritten as :

$$\hat{\sigma}_w^2 = \frac{1}{n-r} w'w , \quad (11)$$

where w is a column vector containing the last $n-r$ residuals w_t ,
($t=1+r, \dots, n$) :

$$w_t = \frac{u_t}{\sqrt{f(X_t)}} - \sum_{\ell=1}^r \rho_\ell \frac{u_{t-\ell}}{\sqrt{f(X_{t-\ell})}} = y_t^{**} - \sum_k X_{kt}^{**} \beta_k \quad (12)$$

and

$$\left. \begin{aligned} y_t^{**} &= y_t^* - \sum_{\ell} \rho_{\ell} y_{t-\ell}^* , \\ X_{kt}^{**} &= X_{kt}^* - \sum_{\ell} \rho_{\ell} X_{k,t-\ell}^* , \\ y_t^* &= y_t^{(\lambda)} / \sqrt{f(X_t)} , \\ X_{kt}^* &= X_{kt}^{(\lambda)} / \sqrt{f(X_t)} , \end{aligned} \right\} \quad (13)$$

In terms of the β_k 's, $\hat{\sigma}_w^2$ can be expressed as :

$$\hat{\sigma}_w^2 = \frac{1}{n-r} (y^{**} - X^{**} \beta)' (y^{**} - X^{**} \beta) , \quad (14)$$

where y^{**} is a column vector containing the last $n-r$ observations on y_t^{**} ; similarly, X^{**} is a $(n-r) \times q$ matrix and β is a q -element column vector.

The first derivative of (10) with respect to vector β is :

$$\begin{aligned} \frac{\partial \text{Log } L^*}{\partial \beta} &= - \frac{n-r}{2} \frac{1}{\hat{\sigma}_w^2} \frac{\partial \hat{\sigma}_w^2}{\partial \beta} = - \frac{1}{\hat{\sigma}_w^2} \left[\frac{\partial (y^{**} - X^{**} \beta)'}{\partial \beta} \right] (y^{**} - X^{**} \beta) \\ &= \frac{1}{\hat{\sigma}_w^2} X^{**'} (y^{**} - X^{**} \beta) = \frac{1}{\hat{\sigma}_w^2} (X^{**'} y^{**} - X^{**'} X^{**} \beta) . \end{aligned} \quad (15)$$

Setting (15) to zero, we obtain for β :

$$\hat{\beta} = (X^{**'} X^{**})^{-1} X^{**'} y^{**} . \quad (16)$$

Replacing β by its value $\hat{\beta}$ in the expression (14), we obtain :

$$\hat{\sigma}_w^2 = \frac{1}{n-r} (y^{**} - X^{**} \hat{\beta})' (y^{**} - X^{**} \hat{\beta}) \quad (17)$$

Finally, the log-likelihood function concentrated on σ_w^2 and β can be written as :

$$\text{Log } L^{**} = -\frac{n-r}{2} [1 + \ln(2\pi)] - \frac{n-r}{2} \ln \hat{\sigma}_w^2 + (\lambda_y - 1) \sum_{t=1+r}^n \ln y_t - \frac{1}{2} \sum_{t=1+r}^n \ln f(X_t) \quad (18)$$

III. Program Description

To maximize the function (18) with respect to ρ , λ_x , λ_y , δ and λ_e , we use a minimization algorithm due to Fletcher and Powell (1963).

The mean features of the program can be summarized as follows :

1. for the fixed part of model (1), the independent variables X_k 's can be subdivided into a few groups, each of which contains the X_k 's affected by a common λ_{xk} so as to reduce the number of λ_{xk} 's, which would be otherwise as great as the number of X_k 's. For some of the groups, the λ_{xk} 's can be fixed and for the others, the λ_{xk} 's are to be estimated. Moreover, there is one particular group which is left untouched by the Box-Cox transformation, namely the group containing the constant term, the dummy variables and the ordinary variables which are not strictly positive for all observations;
2. the constraint of type $\lambda_y = \lambda_{x(i)}$ is allowed where i represents the i -th group of X_k 's and when both parameters are estimated;

3. in the functional form for heteroskedasticity (4), the δ_m 's and λ_{em} 's can be either fixed or estimated;
4. the initial values for every estimated λ_{xk} and λ_{em} can be set equal to unity. The same is true for estimated λ_y ;
5. the initial value for every ρ_ℓ and for every δ_m can be set equal to zero in the case of autocorrelation and heteroskedasticity; in the absence of autocorrelation and heteroskedasticity, the ρ_ℓ 's and the δ_m 's need not be specified;
6. the main reason for choosing the initial values set in 4. and 5. is to start with a linear model without considering the problem of autocorrelation and heteroskedasticity;
7. numerically, the transformation $X_t^{(\lambda)}$ defined in (5) is switched to the form $\ln Z_t$ when $|\lambda| < 10^{-4}$;
8. to avoid numerical problems, all the estimated λ 's are constrained over a region such that $|\lambda| < 20$ (see SUBROUTINE TRANSF) and for the case of heteroskedasticity, when $\lambda_u = 0$, the argument for the exponential defined in (4) is bounded such that $\left| \sum_m \delta_m X_{mt}^{(\lambda_{em})} \right| \leq 650$ (see SUBROUTINE FCN), which is approximately the range of the argument for the exponential function on a CDC-CYBER-173.

IV. Input Formats

Almost all input is in free format, except for TITREY, Y, TITREX and X which are in user specified format.

card type	input contents
1	\$CARD1 NOBS=...,NC=...,NF=...,NFP=...,NOBEL=...,NM=...,NSTEP=...,EPSI=...\$ (80 columns; first column and column following card name must be blanks. Input values must be specified for every parameter.)
2	\$CARD2 NB=...,NRO=...,NSL=...,NGF=...,MAXF=...,NGV=...,MAXV=...,NLY=...,NDM=...,NLE=... ND=...\$ (Same remarks as for CARD1)
3	\$CARD3 NCOR=...,NRES=...,NPW=...,NGUVW=...,NPDQL=...,NCOV=...,NSTORE=...,NGRID=...\$
4	80 columns for comments (first column must be blank)
(5)	(L(I),I=1,NRO),(RO(I),I=1,NRO) (if NRO $\neq$ 0)
(6)	(NUMSL(I),I=1,NGF) (if NSL $\neq$ 0)
(7)	(VLXF(I),I=1,NGF)
(8)	NXF(I),(NUMXF(I,J),J=1,NXF(I)) } (if NGF $\neq$ 0) (Repeat for I=1,NGF)
(9)	(VLXV(I),I=1,NGV)
(10)	NXV(I),(NUMXV(I,J),J=1,NXV(I)) } (if NGV $\neq$ 0) (Repeat for I=1,NGV)
11	VLY (if NLY=0 or 1) or NGXY (if NLY=2),ULY
(12)	(D(I),I=1,ND),(VLE(I),I=1,ND),(NUMX(I),I=1,ND) (if NDM $\neq$ -1)
(13)	(NUMG(I),I=1,NG) (if NG $\neq$ 0)
(14)	NQM,NYEAR (if NPW $\neq$ 0)
15	(IFMT(I),I=1,10) (80 columns)
16	TITREY,(Y(I),(I=1,NOBS)
17	TITREX(J),(X(I,J),I=1,NOBS) (Repeat for J=1,NB+NM)
(18)	TITY TITX NAMP(1),NAMP(1),DPAR(1) NTYPE(1),NGROUP(1) (This card is only required when NAMP(1)=BE) NAMP(2),NAMP(2),DPAR(2) NTYPE(2),NGROUP(2) (This card is only required when NAMP(2)=BE) } (if NSTORE=2; Repeat this card sequence for NGRID grids)

NOTE : The card type number in parentheses indicates that the input card is optional and conditional on the control parameter value specified in cards no. 2 and 3.

V. Input Parameters

- Card type no. 1

- NOBS : total number of observations in the sample
- NC : index number of the first observation in the estimation period
- NF : index number of the last observation in the estimation period
($NC < NF \leq NOBS$)
- NFP : index number of the last observation in the forecast period;
there are $NFP - NF$ periods of forecast ($NF \leq NFP \leq NOBS$). If $NFP = NF$,
no forecast is required
- NOBEL : number of observations used in the last portion of the estimation
period, for the computation of the elasticity coefficients at the
means of the dependent and independent variables
- NM : number of X_k^m not belonging to the X_k 's group for the heteroske-
dasticity case
- NSTEP : maximum number of steps for the maximization of the function.
(Usually, NSTEP can be set at least equal to the square of the
number of parameters in the concentrated log-likelihood function).
- EPSI : convergence parameter for the function ($10^{-4} \leq EPSI \leq 10^{-7}$)

- Card type no. 2

- NB : number of estimated β_k 's, excluding the constant β_0
- NRO : number of estimated ρ_k 's
- NSL : number of X_k 's not affected by the Box-Cox transformation,
excluding the constant ($0 \leq NSL \leq 50$)
- NGF : number of X_k 's groups with fixed λ_{xk} 's
- MAXF : maximum number of variables X_k 's among the NGF groups (if
 $NGF=0$, MAXF must be set equal to zero)
- NGV : number of X_k 's groups with estimated λ_{xk} 's
- MAXV : maximum number of variables X_k 's among the NGV groups (if
 $NGV=0$, MAXV must be set equal to zero)

- NLY : control parameter for λ_y :
- NLY=0 : λ_y is fixed during the maximization
 - NLY=1 : λ_y is estimated
 - NLY=2 : λ_y is estimated and set equal to one of the λ_{xk} 's of the NGV groups
- NDM : control parameter for the δ_m 's :
- NDM=-1 : heteroskedasticity is not considered (NLE must be set equal to zero)
 - NDM=0 : the δ_m 's are fixed during the maximization
 - NDM=1 : the δ_m 's are estimated
- NLE : control parameter for the λ_{em} 's
- NLE=0 : the λ_{em} 's are fixed during the maximization
 - NLE=1 : the λ_{em} 's are estimated
- ND : number of variables X_m 's appearing in $f(X_t)$. (If NDM=-1, ND must be set equal to zero; up to ten variables can be used.)

- Card type no. 3

- NCOR = {
- 0 : no print of correlation matrices
 - 1 : print correlation matrix in terms of X^{**} and y^{**} at the maximum point of the log-likelihood function
 - 2 : print correlation matrices in terms of X and y , and X^{**} and y^{**} respectively at the starting point and the maximum point of the log-likelihood function
- NRES = {
- 0 : no print and no plot of residuals w_t
 - 1 : print and plot of residuals at the maximum point of the log-likelihood function
 - 2 : print and plot of residuals at the starting and maximum points of the log-likelihood function

NPW = $\begin{cases} 0 : & \text{no list of residuals } w_t \text{ by quarters or months} \\ 1 : & \text{list of residuals by quarters (one output line per year)} \\ 2 : & \text{list of residuals by months (one output line per year)} \end{cases}$

NGUVW = $\begin{cases} 0 : & \text{no plot of independent variables against residuals} \\ & u_t, v_t \text{ and } w_t \\ \text{value} : & \text{number of independent variables to be plotted against} \\ & u_t, v_t \text{ and } w_t \text{ (up to ten variables can be used)} \end{cases}$

NPDQL = $\begin{cases} 0 : & \text{no print of autocorrelation and partial autocorrelation function} \\ 1 : & \text{print at the maximum point of the log-likelihood function} \\ 2 : & \text{print at the starting and maximum points of the log-likelihood} \\ & \text{function} \end{cases}$

NCOV = $\begin{cases} 0 : & \text{no print of covariance matrix of the parameters at the maximum} \\ & \text{point of the log-likelihood function} \\ 1 : & \text{print covariance matrix} \end{cases}$

NSTORE = $\begin{cases} 0 : & \text{no storage of function and parameters values on TAPE3, at the} \\ & \text{maximum point of the log-likelihood function} \\ 1 : & \text{storage of function and parameters values on TAPE3 (unformatted} \\ & \text{WRITE), to be used in later runs with NSTORE=2} \\ 2 : & \text{read from TAPE3 the function and parameters values (unformatted} \\ & \text{READ) when NGRID} \neq 0 \end{cases}$

NGRID = $\begin{cases} 0 : & \text{no grid when NSTORE=0 and 1} \\ \text{value} : & \text{number of grids for two estimated parameters around the} \\ & \text{maximum point of the log-likelihood function} \end{cases}$

- Card type no. 4

80 columns for comments (first column must be blank)

- Card type no.(5) and (6)

L : autocorrelation orders associated with the ρ_{ℓ} 's (in ascending order)

RO : initial values for the ρ_{ℓ} 's

NUMSL : variable numbers for the X_k 's in the NSL group

- Card type no.(7) and (8)

VLXF : fixed values for the λ_{xk} 's in the NGF groups

NXF : number of X_k 's per group, for the NGF groups

NUMXF : variable numbers for the X_k 's included in each of the NGF groups

- Card type no.(9) and (10)

VLXV : initial values for the λ_{xk} 's in the NGV groups

NXV : number of X_k 's per group, for the NGV groups

NUMXV : variable numbers for the X_k 's included in each of the NGV groups

- Card type no. 11

VLY : fixed value (if NLY=0) or initial value (if NLY=1) for λ_y

NGXY : group number for the X_k 's with $\lambda_{xk} = \lambda_y$ (if NLY=2)

ULY : upper limit v (before scaling), for the dependent variable y in the computation of $E(y_t)$ when $\lambda_y < 0$, in (29). If the user does not want to specify this limit, he simply sets ULY=0 and a default value of v will be computed from (30).

- Card type no. (12)

D : fixed (if NDM=0) or initial (if NDM=1) values for δ_m 's

VLE : fixed (if NLE=0) or initial (if NLE=1) values for λ_{em} 's

NUMX : variable numbers for the X_m 's entering in $f(X_t)$

- Card type no. (13) and (14)

NUMG : variable numbers of the independent variables to be plotted against the residuals

NQM : Quarter (1,...,4) or month (1,...,12) associated with the first observation in the sample

NYEAR : year (four digits) associated with the first observation in the sample

- Card type no. 15, 16 and 17

IFMT : input format within parentheses for TITREY, Y and TITREX, X

TITREY : variable name for y

Y : observations on y_t ($t=1, \text{NOBS}$); when the forecast option is chosen ($\text{NFP} > \text{NF}$), make sure that observations on y_t ($t=\text{NF}+1, \text{NOBS}$) are always present : if they are not available, a zero value must be input for each of them

TITREX : variable name for X_k or X_m

X : observations on X_{kt} or X_{mt} ($t=1, \text{NOBS}$)

- Card type no. (18)

TITY : parameter label for the vertical axis in the grid : FORMAT (A10)

TITX : parameter label for the horizontal axis in the grid : FORMAT (A10)

NAMP(I), NUMP(I), DPAR(I) are respectively the coded name, the index number and the step size of the parameter ($I=1$ for the parameter on the vertical axis and $I=2$ for the parameter on the horizontal axis) : FORMAT (A2, I2, F10.1)

The following coded names (two characters) are adopted for the parameters :

parameter	β_k	λ_{xk}	λ_y	δ_m	λ_{em}	ρ_l
NAMP(I)	BE	LX	LY	DE	LE	RO

To assign two different parameters to the axes, the order of priority for the parameters on the vertical-horizontal axes must be respected : β_k must precede λ_{xk} ; λ_{xk} must precede λ_y and so on. For example, NAMP(1)=BE and NAMP(2)=DE constitute

a valid choice; but the converse is illegal (NAMP(1)=DE and NAMP(2)=BE).

The index number of the parameter, NUMP, is the location number of the element with respect to each vector β , λ_x , λ_y , δ , λ_e or ρ .

If a grid is desired for λ_y with any other parameter, in the case of NLY=2, one has to specify the λ_{yk} which is set equal to λ_y , instead of λ_y itself, on the NAMP,NUMP,DPAR card. Note that the grid only applies for two estimated parameters.

The step size DPAR can be chosen in the range 0.10 to 0.01 times the standard-error of the parameter. The grid is computed for nine points in each direction, and centered at the maximum point of the log-likelihood function.

NTYPE(I),NGROUP(I) are respectively the type and the group of the λ_{xk} corresponding to the β_k which is chosen as NAMP(I)=BE :
FORMAT (A2,I2). This card is not required when NAMP(I)≠BE.

The type has the following form :

$$\text{NTYPE(I)} = \begin{cases} \text{NL} & : \text{No Lambda} \\ \text{FL} & : \text{Fixed Lambda} \\ \text{EL} & : \text{Estimated Lambda} \end{cases}$$

The group of the λ_{xk} is chosen among the NGF or NGV groups. When NTYPE(I)=NL, NGROUP(I) must be set equal to zero, since there is no lambda associated with this group.

NOTE : The program creates automatically the constant which occupies the last position within the set of X_k 's, i.e. the (NB+1)-th location. The variable numbers for the X_k 's are given by the positions corresponding to the order of appearance of the X_k 's in the set. If there are some X_m 's which do not belong to the X_k 's group (NM≠0), they must be added at the end of this group, and their corresponding positions (hence, their variable numbers), must be counted as NB+1+i (i=1,NM).

VI. Description of Output

1) Scaling of Variables :

To avoid numerical problems, a change of scale for y_t , X_{kt} and X_{mt} is performed by using powers of 10 as the scaling factors :

$$Z'_t = Z_t / 10^{[\log_{10} \bar{Z}]}, \quad (19)$$

where Z_t represents y_t , X_{kt} or X_{mt} ; $\bar{Z}$ is the mean of Z , computed only from the subset of positive observations, and $[\log_{10} \bar{Z}]$ is the greatest integer contained in $\log_{10} \bar{Z}$.

2) Expected Values of the Dependent Variable :

a) Transformed Variable (y^{**})

Since the Box-Cox transformation applies only to strictly positive variables, and in particular for the dependent variable y_t , it will be convenient to assume for the moment that $\epsilon \leq y_t \leq v$, where ϵ is an arbitrary small positive number and v is the upper limit of y_t .

Following (12) and (13), we can write :

$$y_t^{**} = \sum_k X_{kt}^{**} \beta_k + w_t = \frac{y_t^{\lambda_y} - 1}{\lambda_y \sqrt{f(X_t)}} - \sum_l \rho_l y_{t-l}^{*-l} \quad (20)$$

The above assumption for y_t implies that

$$\frac{\epsilon^{\lambda_y} - 1}{\lambda_y \sqrt{f(X_t)}} - \sum_l \rho_l y_{t-l}^{*-l} \leq y_t^{**} \leq \frac{v^{\lambda_y} - 1}{\lambda_y \sqrt{f(X_t)}} - \sum_l \rho_l y_{t-l}^{*-l}, \quad (\lambda_y > 0) \quad (21.a)$$

and

$$\frac{1/\epsilon^{|\lambda_y|} - 1}{\lambda_y \sqrt{f(X_t)}} - \sum_l \rho_l y_{t-l}^{*-l} \leq y_t^{**} \leq \frac{1/v^{|\lambda_y|} - 1}{\lambda_y \sqrt{f(X_t)}} - \sum_l \rho_l y_{t-l}^{*-l}, \quad (\lambda_y < 0) \quad (21.b)$$

Relaxing the assumption ($\epsilon \rightarrow 0$ and $v \rightarrow \infty$), we obtain :

$$\begin{cases} \tilde{y}_t^{**} \leq y_t^{**} < \infty & , \quad (\lambda_y > 0) \\ -\infty < y_t^{**} \leq \tilde{y}_t^{**} & , \quad (\lambda_y < 0) \end{cases} \quad \begin{matrix} (22.a) \\ (22.b) \end{matrix}$$

where
$$\tilde{y}_t^{**} = - \frac{1}{\lambda_y f(X_t)} - \sum_l \rho_l y_{t-l}^* .$$

The expected value of y_t^{**} can then be expressed as :

$$E(y_t^{**}) = \begin{cases} \tilde{y}_t^{**} \int_{-\infty}^{\tilde{w}_t^{**}} N(w) dw + \int_{\tilde{w}_t^{**}}^{\infty} (\sum_k X_{kt}^{**} \beta_k + w) N(w) dw & , \quad (\lambda_y > 0) \\ \int_{-\infty}^{\tilde{w}_t^{**}} (\sum_k X_{kt}^{**} \beta_k + w) N(w) dw + \tilde{y}_t^{**} \int_{\tilde{w}_t^{**}}^{\infty} N(w) dw & , \quad (\lambda_y < 0) \end{cases} \quad \begin{matrix} (23.a) \\ (23.b) \end{matrix}$$

where

$$\tilde{w}_t^{**} = \tilde{y}_t^{**} - \sum_k X_{kt}^{**} \beta_k \quad \text{and} \quad N(w) = (2\pi \sigma_w^2)^{-1/2} \exp(-w^2/2\sigma_w^2) .$$

When $\lambda_y = 0$, it is readily seen that $-\infty < y_t^{**} < \infty$ and we have :

$$E(y_t^{**}) = \int_{-\infty}^{\infty} (\sum_k X_{kt}^{**} \beta_k + w) N(w) dw . \quad (24)$$

Note that $E(y_t^{**})$ can also be computed as :

$$E(y_t^{**}) = \hat{y}_t^{**} + E(w_t) \quad (25)$$

where

$$E(w_t) = \begin{cases} \tilde{w}_t^{**} \int_{-\infty}^{\tilde{w}_t^{**}} N(w) dw + \int_{\tilde{w}_t^{**}}^{\infty} w N(w) dw & , \quad (\lambda_y > 0) \\ 0 & , \quad (\lambda_y = 0) \\ \int_{-\infty}^{\tilde{w}_t^{**}} w N(w) dw + \tilde{w}_t^{**} \int_{\tilde{w}_t^{**}}^{\infty} N(w) dw & , \quad (\lambda_y < 0) \end{cases}$$

b) Original Variable (y)

Reassuming that $\varepsilon \leq y_t \leq v$ and extending Tobin's (1958) formula to a doubly censored dependent variable [Dagenais, Gaudry and Liem (1980)], the expected value of y_t can be written as follows :

$$E(y_t) = \varepsilon \int_{-\infty}^{w_t(\varepsilon)} N(w) dw + \int_{w_t(\varepsilon)}^{w_t(v)} y_t(w) N(w) dw + v \int_{w_t(v)}^{\infty} N(w) dw \quad (26)$$

where

$$w_t(\xi) = \begin{cases} \frac{\xi^{\lambda_y} - 1}{\lambda_y \sqrt{f(X_t)}} - \sum_{\ell} \rho_{\ell} y_{t-\ell}^* - \sum_k X_{kt}^{**} \beta_k & , \quad (\lambda_y \neq 0) \\ \frac{\ln(\xi)}{\sqrt{f(X_t)}} - \sum_{\ell} \rho_{\ell} \frac{\ln(y_{t-\ell})}{\sqrt{f(X_{t-\ell})}} - \sum_k X_{kt}^{**} \beta_k & , \quad (\lambda_y = 0) \end{cases}$$

and

$$y_t(w) = \begin{cases} [1 + \lambda_y \sqrt{f(X_t)} (\sum_{\ell} \rho_{\ell} y_{t-\ell}^* + \sum_k X_{kt}^{**} \beta_k + w)]^{1/\lambda_y} & , \quad (\lambda_y \neq 0) \\ \exp \left[\sqrt{f(X_t)} (\sum_{\ell} \rho_{\ell} \frac{\ln(y_{t-\ell})}{\sqrt{f(X_{t-\ell})}} + \sum_k X_{kt}^{**} \beta_k + w) \right] & , \quad (\lambda_y = 0) \end{cases}$$

When $\lambda_y > 0$, as $\epsilon \rightarrow 0$ and $v \rightarrow \infty$, the first and last terms on the RHS of (26) vanish and the expression reduces to :

$$E(y_t) = \int_{w_t^{**}}^{\infty} y_t(w) N(w) dw \quad . \quad (27)$$

For the case $\lambda_y = 0$, the expression (26) can be simplified in the same way, as $\epsilon \rightarrow 0$ and $v \rightarrow \infty$:

$$E(y_t) = \int_{-\infty}^{\infty} y_t(w) N(w) dw \quad . \quad (28)$$

When $\lambda_y < 0$, as $\epsilon \rightarrow 0$, $w_t(\epsilon) \rightarrow -\infty$ and the first term on the RHS of (26) disappears :

$$E(y_t) = \int_{-\infty}^{w_t(v)} y_t(w) N(w) dw + v \int_{w_t(v)}^{\infty} N(w) dw \quad . \quad (29)$$

If we let now v tend to infinity, then $w_t(v) \rightarrow \tilde{w}_t^{**}$ and $E(y_t)$ does not have any finite value. In that case, the experimenter is asked to supply a reasonable value of v for which $E(y_t)$ can be computed. If the value of v is not specified, the program will generate a default value which is set as follows :

$$v = \min [\max (y_t) + 10 \sigma_y, (-0.8 \sigma_w \lambda_y)^{1/\lambda_y}] \quad , \quad (30)$$

where σ_y is the sample standard error of y_t .

The probability of y not to be at the limit (ϵ for $\lambda > 0$ or v for $\lambda < 0$) is used as a sample measure of the degree of approximation of $E(y_t)$ in (27) and (29) :

$$\left. \begin{aligned} \Pr(y > \epsilon) &= \prod_{t=1+r}^n \left(1 - \int_{-\infty}^{w_t(\epsilon)} N(w) dw\right), \quad (\lambda_y > 0) \\ \text{and} \\ \Pr(y < v) &= \prod_{t=1+r}^n \left(1 - \int_{w_t(v)}^{\infty} N(w) dw\right), \quad (\lambda_y < 0) \end{aligned} \right\} \quad (31)$$

3) Measures of the Coefficient of Determination

Two measures of R^2 are computed in the program.

a) Pseudo-(E)- R^2 :

$$R_E^2 = 1 - \frac{\sum_{t=1+r}^n (y_t - E(y_t))^2}{\sum_{t=1+r}^n (y_t - \bar{y})^2}, \quad (32)$$

where $E(y_t)$ is computed from (27), (28) and (29), depending on the value of λ_y .

b) Pseudo-(L)- R^2 :

$$R_L^2 = 1 - \Lambda^{2/N} \quad (33)$$

where $N = n-r$ and $\Lambda = \max_{\Pi \in \omega} L(\Pi) / \max_{\Pi \in \Omega} L(\Pi)$ is the ratio of two maximum

likelihood functions, one corresponding to the region ω in the parameter space Ω , specified under the null hypothesis $H : \tilde{\beta} = 0$ for the linear case without autocorrelation and heteroskedasticity ($\tilde{\beta}$ is the regression coefficient vector containing the elements of β , except the coefficient for the constant term), and the other associated with the more or less restricted parameter space Ω for $\Pi = (\beta', \rho', \lambda_x', \lambda_y', \delta', \lambda_e', \sigma_w^2)'$.

An explicit form of $\Lambda^{2/N}$ in terms of y_t and y_t^{**} can be obtained :

$$\Lambda^{2/N} = \frac{\sum_{t=1+r}^n (y_t^{**} - \hat{y}_t^{**})^2}{\sum_{t=1+r}^n (y_t - \bar{y})^2} \left\{ \sum_{t=1+r}^n [y_t^{\lambda_y - 1} / \sqrt{f(X_t)}] \right\}^{-2/N} \quad (34)$$

It is readily seen that R_L^2 is identical to R_E^2 in the classical linear regression case without autocorrelation and heteroskedasticity.

4) Elasticity Coefficients

Two types of elasticity coefficients are computed in the program.

a) Elasticity Coefficient in Terms of the Sample Value of y_t

$$\eta_{jt}^{(s)} = \frac{\partial y_t}{\partial X_{jt}} \frac{X_{jt}}{y_t} = \frac{1}{\lambda_y} (X_{jt}^{\lambda_{xj}} \beta_j + G_{jt}) \quad , \quad (35)$$

where

$$G_{jt} = \begin{cases} 0 & , \text{ if } f(X_t) \text{ is not a function of } X_{jt}; \\ \frac{1}{2} X_{mt}^{\lambda_{em}} \delta_m (y_t^{\lambda_y}) - \sum_k X_{kt}^{\lambda_{xk}} \beta_k & , \text{ if } f(X_t) \text{ contains one } X_{mt} = X_{jt} . \end{cases}$$

The superscript (s) indicates that the elasticity is derived with respect to the sample value of y_t . The program computes the elasticity coefficient at the means of two different sets of observations on the dependent and independent variables :

- i) means of observations for the whole estimation period, namely observations from period $t+r$ to n ;
- ii) means of observations for the last portion of the estimation period, namely for the last NOBEL periods.

b) Elasticity Coefficient in Terms of $E(y_t)$

$$\eta_{jt}^{(e)} = \frac{\partial E(y_t)}{\partial X_{jt}} \frac{X_{jt}}{E(y_t)}$$

$$\eta_{jt}^{(e)} = \frac{1}{E(y_t)} \int_{R(w)} [y_t(w)]^{1-\lambda_y} [X_{jt}^{\lambda_{xj}} \beta_j + H_{jt}(w)] N(w) dw, \quad (36)$$

where

$$H_{jt}(w) = \begin{cases} 0, & \text{if } f(X_t) \text{ is not a function of } X_{jt}; \\ \frac{1}{2} X_{mt}^{\lambda_{em}} \delta_m \sqrt{f(X_t)} \left[\sum_{\ell} \rho_{\ell} (y_{t-\ell}^* - \sum_k X_{k,t-\ell}^* \beta_k) + w \right], & \text{if } f(X_t) \text{ contains one } X_{mt} = X_{jt}; \end{cases}$$

and $R(w)$ is the domain of integration $[\tilde{w}_t^{**}, \infty]$, $[-\infty, \infty]$ or $[-\infty, w_t(v)]$ for w when $\lambda_y > 0$, $\lambda_y = 0$ or $\lambda_y < 0$ respectively.

The superscript (e) indicates that the elasticity is derived with respect to the expected value of y_t , $E(y_t)$, which is given in (27), (28) and (29) depending on the value of λ_y . Unlike the elasticity $\eta_{jt}^{(s)}$, the elasticity $\eta_{jt}^{(e)}$ is also a function of the lagged values of the dependent and independent variables: when the elasticity coefficient is computed at the means, the unlagged values are replaced by their means as in the case of $\eta_{jt}^{(s)}$, but the lagged values must be replaced by the means of observations lagged for ℓ periods, for each set of observations.

When $\lambda_y = 0$ and $f(X_t)$ is not a function of X_{jt} , $\eta_{jt}^{(s)}$ and $\eta_{jt}^{(e)}$ are identical and equal to $X_{jt}^{xj} \beta_j$; furthermore, if $\lambda_{xj} = 0$, we obtain the well known result when both y_t and X_{jt} are in logarithmic form, namely $\eta_{jt}^{(s)} = \eta_{jt}^{(e)} = \beta_j$.

5) Analysis of Residuals with Autocorrelation and Partial Autocorrelation Functions

At the initial and final stages of the maximization of Log L** given in (18), autocorrelation and partial autocorrelation functions are evaluated for the residual term w_t defined in (12).

Following the notation of Box-Jenkins (1976), a differencing operation is first applied to the series w_t :

$$\tilde{w}_t = (1 - B)^d (1 - B^s)^D w_t, \quad (t=1+r, \dots, n) \quad (37)$$

where B is the backward shift operator defined by $Bw_t = w_{t-1}$, hence $B^m w_t = w_{t-m}$, d is the degree of consecutive differencing, D is the degree of seasonal differencing and s is the period of seasonal differencing.

The following values are printed out :

a) Autocorrelation Function :

$$r_k = c_k / c_0, \quad k=0, 1, \dots, K, \quad (38)$$

where c_k is the autocovariance function of lag k :

$$c_k = \sum_{t=1+r}^{n-k} (\tilde{w}_t - \bar{\tilde{w}}) (\tilde{w}_{t+k} - \bar{\tilde{w}}) / (n-r), \quad (39)$$

$\bar{\tilde{w}}$ is the mean of $\tilde{w}_t$ and K is the maximum lag of autocovariance and autocorrelation functions. Note that c_0 is the variance of $\tilde{w}_t$.

b) Partial Autocorrelation Function :

$$\hat{\phi}_{\ell\ell} = \begin{cases} r_1 & , & \text{for } \ell=1 & , \\ \frac{r_\ell - \sum_{j=1}^{\ell-1} \hat{\phi}_{\ell-1,j} r_{\ell-j}}{1 - \sum_{j=1}^{\ell-1} \hat{\phi}_{\ell-1,j} r_j} & , & \ell=2,3,\dots,L & , \end{cases} \quad (40)$$

where L is the maximum lag of partial autocorrelation function, and

$$\hat{\phi}_{\ell j} = \hat{\phi}_{\ell-1,j} - \hat{\phi}_{\ell\ell} \hat{\phi}_{\ell-1,\ell-j} \quad , \quad j=1,2,\dots,\ell-1 \quad .$$

c) estimated standard errors for the autocorrelations and partial autocorrelations are printed next to each row of output and apply to all entries in that row.

Both consecutive and seasonal differencing may be applied more than once or together to produce higher order differences. In the program, the fixed values of d, D, s, K, and L are respectively 1, 1, 12, 36, 12 if $n-r \geq 50$: otherwise, the residuals w_t will not be analyzed even if $NPDQL \neq 0$; the user may wish to change this. The allowed ranges for d, D, s, K and L are :

$$\begin{aligned} 0 \leq d \leq 3, & \quad 0 \leq D \leq 3, & \quad 0 \leq s \leq 12, & \quad d + sD \leq n-r, \\ \text{and} \quad 1 \leq K \leq 50, & \quad 1 \leq L \leq 12, & \quad K \leq L. \end{aligned}$$

6) Plot of Residuals Against One Independent Variable

At the initial and final steps of the maximization process, the estimated residuals of u_t , v_t and w_t are plotted around their means, against the

observations ordered by increasing values of one selected independent variable, to provide a graphical analysis of the functional form of heteroskedasticity related to this variable.

The residuals are plotted to scale on the horizontal axis, whereas on the vertical axis, the independent variable is not, due to the length of the series : one line skipping represents an observation, independently of the value of the observation.

7) Change of Parameter Space

During the maximization procedure for $\text{Log } L^{**}$, a constraint on each parameter ρ_ℓ ($\ell=1, \dots, r$) is introduced implicitly by a change of space for ρ_ℓ ; we use the Fisher's z-transformation which is defined as :

$$z_\ell = \frac{1}{2} \ln \frac{1 + \rho_\ell}{1 - \rho_\ell}, \quad -1 < \rho_\ell < 1 \quad \text{and} \quad -\infty < z_\ell < +\infty. \quad (41)$$

In other words, we have changed a maximization problem with constraints into one without constraints : the output parameter values between iterations are thus in terms of z , λ_x , λ_y , δ and λ_e . Note that the inverse transformation of (41) is $\rho_\ell = \tanh z_\ell$.

8) Likelihood Ratio Test

At the end of the maximization process, a likelihood ratio test is performed by computing the following statistic :

$$-2 (\text{Log } L_0^{**} - \text{Log } L_1^{**}) \quad , \quad (42)$$

which is distributed asymptotically as χ^2 , with degrees of freedom equal to the difference in the numbers of parameters involved in the two models, where L_0^{**} is the maximum of the likelihood function associated with the initial model (at the beginning of the iterations) and L_1^{**} is the maximum of the likelihood function associated with the final model (at the end of the iterations).

9) Asymptotic Covariance Matrix for the Parameters

To compute the asymptotic covariance matrix for the parameters β , ρ , λ_x , λ_y , δ , λ_e and σ_w^2 at the maximum point of the likelihood function, we use the fundamental statistical relation that the asymptotic covariance matrix of a maximum likelihood estimator is equal to the inverse of the covariance matrix of the gradient of the likelihood function (Kendall and Stuart, p. 55, vol. II (1967); for an application of the theorem in a nonlinear structural model, see Berndt, Hall and al. (1974)).

The gradient of the log-likelihood function (7) can be written as :

$$\frac{\partial \text{Log } L}{\partial \Pi_i} = \sum_{t=1+r}^n D_{t,i} \quad , \quad (43)$$

where Π_i represents a typical element of β , ρ , λ_x , λ_y , δ , λ_e and σ_w^2 ; $D_{t,i}$ is defined as :

$$D_{t,i} = \begin{cases} \frac{\partial(\lambda_y - 1)}{\partial \Pi_i} \ln y_t - \frac{1}{2} \frac{\partial \ln f(X_t)}{\partial \Pi_i} - \frac{w_t}{\sigma_w^2} \frac{w_t}{\partial \Pi_i} & \text{if } \Pi_i \neq \sigma_w^2 \\ \left(\frac{w_t^2}{\sigma_w^2} - 1 \right) / 2\sigma_w^2 & \text{if } \Pi_i = \sigma_w^2 \end{cases} \quad (44)$$

At the maximum of the log-likelihood function, the asymptotic covariance matrix of the parameters is estimated by :

$$\text{COV} = \left[\sum_{t=1+r}^n D_t D_t' \right]^{-1} \quad (45)$$

where D_t is a column vector with $D_{t,i}$ as a typical element.

Note that the covariance matrix is output in a lower triangular form.

The different derivatives involved in the expression for $D_{t,i}$, when $\Pi_i \neq \sigma_w^2$, are given below.

$$\frac{\partial(\lambda_y - 1)}{\partial \Pi_i} = \begin{cases} 0 & \text{if } \Pi_i \neq \lambda_y \\ 1 & \text{if } \Pi_i = \lambda_y \end{cases} \quad (46)$$

Π_i	$\partial w_t / \partial \Pi_i$
β_k	$- X_{kt}^{**}$
ρ_ℓ	$-(y_{t-\ell}^* - \sum_k X_{k,t-\ell}^* \beta_k)$
λ_{xk}	$-\beta_k \left[\frac{1}{\sqrt{f(X_t)}} \frac{\partial X_{kt}^{(\lambda_{xk})}}{\partial \lambda_{xk}} - \sum_\ell \frac{\rho_\ell}{\sqrt{f(x_{t-\ell})}} \frac{\partial X_{k,t-\ell}^{(\lambda_{xk})}}{\partial \lambda_{xk}} \right]$

λ_y	$\frac{1}{\sqrt{f(X_t)}} \frac{\partial y_t^{(\lambda_y)}}{\partial \lambda_y} - \sum_{\ell} \frac{\rho_{\ell}}{\sqrt{f(X_{t-\ell})}} \frac{\partial y_{t-\ell}^{(\lambda_y)}}{\partial \lambda_y}$
δ_m	$- \frac{1}{2} (y_t^* - \sum_k X_{kt}^* \beta_k) X_{mt}^{(\lambda_{em})} - \sum_{\ell} \rho_{\ell} (y_{t-\ell}^* - \sum_k X_{k,t-\ell}^* \beta_k) X_{m,t-\ell}^{(\lambda_{em})}$
λ_{em}	$- \frac{1}{2} \delta_m \left[(y_t^* - \sum_k X_{kt}^* \beta_k) \frac{\partial X_{mt}^{(\lambda_{em})}}{\partial \lambda_{em}} - \sum_{\ell} \rho_{\ell} (y_{t-\ell}^* - \sum_k X_{k,t-\ell}^* \beta_k) \frac{\partial X_{m,t-\ell}^{(\lambda_{em})}}{\partial \lambda_{em}} \right]$

Π_1	$\partial \ln f(X_t) / \partial \Pi_1$
β_k	0
ρ_{ℓ}	0
λ_{xk}	0
λ_y	0
δ_m	$X_{mt}^{(\lambda_{em})}$
λ_{em}	$\delta_m \frac{\partial X_{mt}^{(\lambda_{em})}}{\partial \lambda_{em}}$

To compute the different derivatives $\partial y_t^{(\lambda_y)} / \partial \lambda_y$, $\partial x_{kt}^{(\lambda_{xk})} / \partial \lambda_{xk}$ and $\partial x_{mt}^{(\lambda_{em})} / \partial \lambda_{em}$, the following formulas are used :

$$\frac{\partial z_t^{(\lambda)}}{\partial \lambda} = \begin{cases} \frac{1}{2} (\ln z_t)^2 & , \text{ if } \lambda = 0 \\ \frac{1}{\lambda} (z_t^\lambda \ln z_t - z_t^{(\lambda)}) & , \text{ if } \lambda \neq 0 \end{cases} \quad (47)$$

The derivatives for the case $\lambda = 0$ are actually computed for very small values of λ , say $|\lambda| < 10^{-4}$.

10) Correlation Matrices

A correlation matrix for the independent variables (excluding the constant) and the dependent variable in terms of the original variables (X and y) is always given before the maximization procedure begins. Another correlation matrix in terms of the transformed variables (X** and y**) is finally computed at the maximum of the log-likelihood function.

The matrices are stored and output in a lower triangular form, where the last row represents the pairwise correlations between each of the independent variables and the dependent variable.

11) Student-t Statistics

In the final table where the estimated values of the parameters (β , ρ , λ_x , λ_y , δ , λ_e) are reported, the t-tests are computed under the hypothesis that the parameter is equal to zero. For λ_x , λ_y and λ_e , an additional t-test (given in the second row for each entry of λ) is performed under the hypothesis that the parameter is equal to one.

When the program fails to converge to a maximum point, the covariance matrix of the parameters cannot be estimated; then the standard errors will be set equal to unity so that the final table can be printed to give information about the gradient : in that case, all the Student-t statistics shown are not correct.

12) Forecasting

a) Maximum Likelihood Forecast

To obtain the predicted values of the dependent variable over the p periods from $n+1$ to $n+p$, the following approach is adopted : for the first period of forecast, the predicted value of y_{n+1} is given by the first-order condition $\partial \text{Log } L_{n+1} / \partial y_{n+1} = 0$, since maximizing $\sum_{t=1+r}^{n+1} \text{Log } L_t$ with respect to y_{n+1} is equivalent to maximizing the log-likelihood function in the $(n+1)$ -th period only.

The first derivative of the log-likelihood function associated with the $(n+1)$ -th period, with respect to y_{n+1} , can be written as :

$$\frac{\partial \text{Log } L_{n+1}}{\partial y_{n+1}} = \frac{1}{y_{n+1}} \left[\lambda_y - 1 - \frac{y_{n+1}^{\lambda_y}}{\sigma_w^2 f(X_{n+1})} \left(\frac{u_{n+1}}{\sqrt{f(X_{n+1})}} - \sum_{\ell} \rho_{\ell} \frac{u_{n+1-\ell}}{\sqrt{f(X_{n+1-\ell})}} \right) \right]$$

Setting this derivative equal to zero and solving for $y_{n+1}^{\lambda_y}$, we obtain an equation of the second degree in $y_{n+1}^{\lambda_y}$:

$$2\lambda_y y_{n+1}^{\lambda_y} + B y_{n+1}^{\lambda_y} + C = 0$$

where

$$B = - \left[1 + \lambda_y \sqrt{f(X_{n+1})} \left(\sum_k \beta_k \frac{x_{k,n+1}^{(\lambda_{xk})}}{\sqrt{f(X_{n+1})}} + \sum_\ell \rho_\ell \frac{u_{n+1-\ell}}{\sqrt{f(X_{n+1-\ell})}} \right) \right]$$

and

$$C = - \lambda_y (\lambda_y - 1) \sigma_w^2 f(X_{n+1}) .$$

Since the predicted value of y_{n+1} must be real and positive, the values of $y_{n+1}^{\lambda_y} = (-B \pm \sqrt{B^2 - 4C})/2$ are subject to the same restrictions, namely $B^2 - 4C \geq 0$ and $y_{n+1}^{\lambda_y} > 0$. If the two roots of $y_{n+1}^{\lambda_y}$ are both real and positive, the root associated with the higher log-likelihood function is chosen. Finally, the obtained solution for y_{n+1} must also satisfy the second order condition that $\partial^2 \text{Log } L_{n+1} / \partial y_{n+1}^2$ be negative.

Clearly, the approach can be easily extended to the next periods, since in each single period of forecast, only the log-likelihood function associated with that period is needed for the maximization, given the sample observed values of the dependent variable in the estimation period and its predicted values in the preceding forecast periods. Thus, for the p -th period of forecast, the predicted value of y_{n+p} is also given by the first order condition $\partial \text{Log } L_{n+p} / \partial y_{n+p} = 0$, subject to the second order condition $\partial^2 \text{Log } L_{n+p} / \partial y_{n+p}^2 < 0$. The formulas are analogous to (48) and (49) with $n+1$ replaced by $n+p$.

The variance of the forecast error for the first period of forecast is computed from the covariance matrix of the parameters Π and y_{n+1} , which is equal to minus the inverse matrix of the second derivatives of the log-likelihood

function $\text{Log } L_{(1)} = \sum_{t=1+r}^{n+1} \text{Log } L_t$ with respect to Π and y_{n+1} , evaluated at the maximum point of the function :

$$\text{COV}_{(1)} = - \begin{bmatrix} \frac{\partial^2 \text{Log } L_{(1)}}{\partial \Pi \partial \Pi'} & \frac{\partial^2 \text{Log } L_{(1)}}{\partial \Pi \partial y_{n+1}} \\ \frac{\partial^2 \text{Log } L_{(1)}}{\partial y_{n+1} \partial \Pi'} & \frac{\partial^2 \text{Log } L_{(1)}}{\partial y_{n+1}^2} \end{bmatrix}^{-1}, \quad (50)$$

where Π is a column vector of the parameters β , ρ , λ_x , λ_y , δ , λ_e and σ_w^2 , and the underscript in parentheses (1) indicates that the first period of forecast is concerned.

But the rule of partitioned matrix inversion, the variance of the forecast error for y_{n+1} can be obtained :

$$\sigma_{n+1}^2 = - \left[\frac{\partial^2 \text{Log } L_{(1)}}{\partial y_{n+1}^2} \right]^{-1} + \left[\frac{\partial^2 \text{Log } L_{(1)}}{\partial y_{n+1}^2} \right]^{-1} \left[\frac{\partial^2 \text{Log } L_{(1)}}{\partial y_{n+1} \partial \Pi'} \right] \text{COV}_{(o)} \left[\frac{\partial^2 \text{Log } L_{(1)}}{\partial \Pi \partial y_{n+1}} \right] \left[\frac{\partial^2 \text{Log } L_{(1)}}{\partial y_{n+1}^2} \right]^{-1}, \quad (51)$$

where $\text{COV}_{(o)}$ is the covariance matrix of Π already estimated in (45) .

Proceeding in a recursive manner, the variance of the forecast error for the p -th period can be written as :

$$\sigma_{n+p}^2 = - \left[\frac{\partial^2 \text{Log } L_{(p)}}{\partial y_{n+p}^2} \right]^{-1} + \left[\frac{\partial^2 \text{Log } L_{(p)}}{\partial y_{n+p}^2} \right]^{-1} \left[\frac{\partial^2 \text{Log } L_{(p)}}{\partial y_{n+p} \partial \Pi'_{(p-1)}} \right] \text{COV}_{(p-1)} \left[\frac{\partial^2 \text{Log } L_{(p)}}{\partial \Pi_{(p-1)} \partial y_{n+p}} \right] \left[\frac{\partial^2 \text{Log } L_{(p)}}{\partial y_{n+p}^2} \right]^{-1}, \quad (52)$$

where $\text{COV}_{(p-1)}$ is the covariance matrix of $\Pi_{(p-1)} = (\Pi', y_{n+1}, \dots, y_{n+p-1})'$

and $\text{Log } L_{(p)} = \sum_{t=1+p}^{n+p} \text{Log } L_t$. Note that the second derivatives

$\partial^2 \text{Log } L_{(p)} / \partial \Pi_{(p-1)} \partial y_{n+p}$ and $\partial^2 \text{Log } L_{(p)} / \partial y_{n+p}^2$ are respectively equal to

$\partial^2 \text{Log } L_{n+p} / \partial \Pi_{(p-1)} \partial y_{n+p}$ and $\partial^2 \text{Log } L_{n+p} / \partial y_{n+p}^2$ since y_{n+p} appears only in $\text{Log } L_{n+p}$.

The second derivatives of $\text{Log } L_{n+p}$ with respect to $\Pi_{(p)} = (\Pi', y_{n+1}, \dots, y_{n+p})'$ and y_{n+p} are in the form $y_{n+p}^{\lambda y-1} / [\sigma_w^2 \sqrt{f(X_{n+p})}]$ times an expression which is given below for each case :

parameter	y_{n+p}
β_k	$\frac{x_{k,n+p}^{(\lambda_{xk})}}{\sqrt{f(X_{n+p})}} - \sum_{\ell} \rho_{\ell} \frac{x_{k,n+p-\ell}^{(\lambda_{xk})}}{\sqrt{f(X_{n+p-\ell})}}$
ρ_{ℓ}	$\frac{y_{n+p-\ell}^{(\lambda_y)} - \sum_k \beta_k x_{k,n+p-\ell}^{(\lambda_{xk})}}{\sqrt{f(X_{n+p-\ell})}}$

λ_{xk}	$\beta_k \left[\frac{1}{\sqrt{f(X_{n+p})}} \frac{\partial X_{k,n+p}^{(\lambda_{xk})}}{\partial \lambda_{xk}} - \sum_{\ell} \frac{\rho_{\ell}}{\sqrt{f(X_{n+p-\ell})}} \frac{\partial X_{k,n+p-\ell}^{(\lambda_{xk})}}{\partial \lambda_{xk}} \right]$
λ_y	$\frac{\sigma_w^2 \sqrt{f(X_{n+p})}}{\lambda_y} - w_{n+p} \ln(y_{n+p}) - \left[\frac{1}{\sqrt{f(X_{n+p})}} \frac{\partial y_{n+p}^{(\lambda_y)}}{\partial \lambda_y} - \sum_{\ell} \frac{\rho_{\ell}}{\sqrt{f(X_{n+p-\ell})}} \frac{\partial y_{n+p-\ell}^{(\lambda_y)}}{\partial \lambda_y} \right]$
δ_m	$\frac{1}{2} \left[\left(\frac{2 u_{n+p}}{\sqrt{f(X_{n+p})}} - \sum_{\ell} \rho_{\ell} \frac{u_{n+p-\ell}}{\sqrt{f(X_{n+p-\ell})}} \right) X_{m,n+p}^{(\lambda_{em})} - \sum_{\ell} \rho_{\ell} \frac{u_{n+p-\ell}}{\sqrt{f(X_{n+p-\ell})}} X_{m,n+p-\ell}^{(\lambda_{em})} \right]$
λ_{em}	$\frac{\delta_m}{2} \left[\left(\frac{2 u_{n+p}}{\sqrt{f(X_{n+p})}} - \sum_{\ell} \rho_{\ell} \frac{u_{n+p-\ell}}{\sqrt{f(X_{n+p-\ell})}} \right) \frac{\partial X_{m,n+p}^{(\lambda_{em})}}{\partial \lambda_{em}} - \sum_{\ell} \rho_{\ell} \frac{u_{n+p-\ell}}{\sqrt{f(X_{n+p-\ell})}} \frac{\partial X_{m,n+p-\ell}^{(\lambda_{em})}}{\partial \lambda_{em}} \right]$
σ_w^2	w_{n+p} / σ_w^2
y_{n+p-s}	$\frac{\rho_s}{\sqrt{f(X_{n+p-s})}} \lambda_y^{-1} y_{n+p-s}, \text{ where } s=1, \dots, \min(p-1, r) \text{ and } p \geq 2.$
y_{n+p}	$- (2 \lambda_y y_{n+p} + B) / (y_{n+p} \sqrt{f(X_{n+p})})$

The different derivatives $\partial y_{n+p}^{(\lambda_y)} / \partial \lambda_y$, $\partial X_{k,n+p}^{(\lambda_{xk})} / \partial \lambda_{xk}$ and $\partial X_{m,n+p}^{(\lambda_{em})} / \partial \lambda_{em}$ can be computed, using the formulas shown in (47).

In evaluating the second derivatives of $\text{Log } L_{n+p}$ at the maximum point of the log likelihood function $\text{Log } L_{(p)}$, the predicted values of $y_{n+1}, \dots, y_{n+p}$ obtained by the approach above, are used just as when the predicted value of y_{n+p} is computed, the predicted values of $y_{n+1}, \dots, y_{n+p-1}$ are also used.

Finally, the following recursive formula can be used to construct the covariance matrix of $\Pi_{(i)}$, at the i -th forecast period :

$$\text{COV}_{(i)} = \begin{bmatrix} \text{COV}_{(i-1)} & C_{(i)} \\ C'_{(i)} & \sigma_{n+1}^2 \end{bmatrix}, \quad (53)$$

where σ_{n+1}^2 is the variance of the forecast error for y_{n+1} , and $C_{(i)}$ is the column vector of covariances between $\Pi_{(i-1)}$ and y_{n+1} :

$$C_{(i)} = - \text{COV}_{(i-1)} \begin{bmatrix} \frac{\partial^2 \text{Log } L_{(i)}}{\partial \Pi_{(i-1)} \partial y_{n+1}} \end{bmatrix} \begin{bmatrix} \frac{\partial^2 \text{Log } L_{(i)}}{\partial y_{n+1}^2} \end{bmatrix}^{-1}.$$

The error of forecast is computed in percentage, whenever the sample observed value of the dependent variable is available in the forecast periods :

$$\hat{e}_t = (1 - \hat{y}_t / y_t^0) 100, \quad (t=n+1, \dots, n+p) \quad (54)$$

where $\hat{y}_t$ and y_t^0 are respectively the predicted and observed values of y_t .

The 95% confidence interval for y_t is also computed :

$$\hat{y}_t - 1.96 \hat{\sigma}_t \leq y_t \leq \hat{y}_t + 1.96 \hat{\sigma}_t, \quad (t=n+1, \dots, n+p) \quad (55)$$

where $\hat{\sigma}_t$ is estimated from (51) and (52).

b) Simulation Forecast

In addition to the maximum likelihood predicted value, the simulated value of the dependent variable is computed as :

$$\tilde{y}_t = \left\{ \begin{array}{ll} \left[1 + \lambda_y \sqrt{f(X_t)} \left(\sum_{\ell} \rho_{\ell} y_{t-\ell}^* + \sum_k X_{kt}^{**} \beta_k \right) \right]^{1/\lambda_y} & (\lambda_y \neq 0) \\ \exp \left[\sqrt{f(X_t)} \left(\sum_{\ell} \rho_{\ell} \frac{\ln y_{t-\ell}}{\sqrt{f(X_t)}} + \sum_k X_{kt}^{**} \beta_k \right) \right] & (\lambda_y = 0) \end{array} \right\} \quad (t=n+1, \dots, n+p) \quad (56)$$

where the $y_{t-\ell}$ is replaced by $\tilde{y}_{t-\ell}$ if $t-\ell > n$.

For the case $\lambda_y \neq 0$, if the expression between the squared brackets happens to be negative, then it cannot be raised to the power $1/\lambda_y$: the program will be stopped at that point of the run.

VII. Sample Deck Structure and Print-Out

The sample deck given below illustrates a model with :

- 1) a dependent variable $y = \text{XCANFA}$;
- 2) and twenty-six independent variables $X_1 = \text{FAD}, \dots, X_{26} = \text{ANTLL}$
(the constant term, generated in the program itself, is defined as $X_{27} = \text{CONSTANT}$) .

The NSL group includes fourteen independent variables : $X_8, \dots, X_{11}, X_{13}, X_{15}, \dots, X_{21}, X_{25}, X_{26}$. By convention, X_{27} need not be declared as pertaining to the NSL group : it is automatically assigned to this group.

There are five NGV groups :

- 1) the first contains X_1, X_2 and X_3 with a common $\lambda_{x(1)}$,
- 2) the second : X_4 with $\lambda_{x(2)}$,
- 3) the third : X_5, X_6 and X_7 with a common $\lambda_{x(3)}$,
- 4) the fourth : X_{12} and X_{14} with a common $\lambda_{x(4)}$,
- 5) the fifth : X_{22}, X_{23} and X_{24} with a common $\lambda_{x(5)}$.

The type of λ_{xk} associated with the independent variables is indicated by :

NL = "No Lambda", for the NSL group (this group is numbered as "0");

FL = "Fixed Lambda", for the NGF groups;

EL = "Estimated Lambda", for the NGV groups.

For the dependent variable y , there is one λ_y to be estimated separately along with the λ_x .

The autocorrelation structure of first and twelfth orders is considered. For the heteroskedasticity case, there is only one independent variable,

X_{14} = SHONF, involved in $f(X_t)$. The plots of the residuals u_t , v_t and w_t against X_{14} are given at the initial and final steps of the maximization process. Finally the forecast option is illustrated with three periods.

SAMPLE DECK STRUCTURE

(as executed on a CDC-CYBER-173,
at the Université de Montréal)

CONTROL
STATEMENTS

[U3049,CM130000,T700.
*CODE
FTN.
LGO(PL=20000)
*WEOR

FORTRAN
SOURCE
DECK

[

*WEOR

```

_CARD1_NOBS=181,NO=13,NF=178,NFP=181,NOBEL=12,NM=0,NSTEP=100,EPSI=1,E-7$
_CARD2_NB=26,NRO=2,NSL=14,NGF=0,MAXF=0,NGV=5,MAXV=3,NLY=1,NDM=1,NLE=1,ND=1$
_CARD3_NCOR=2,NRES=2,NPW=2,NGUVW=1,NPDQL=2,NCOV=1,NSTORE=0,NGRID=0$
_AUTO(1,12)-5 GROUPS OF LAMBDA(X) - 1 LAMBDA(Y) - 1 DELTA - 1 LAMBDA(E)
1_12_0_0.
8_9_10_11_13_15_16_17_18_19_20_21_25_26
1._1._1._1._1.
3_1_2_3
1_4
3_5_6_7
2_12_14
3_22_23_24
1._0.
0._1._14
14
12_1956
(3XA8,54E15.7/(20X4E15.7))
Variable name and observations for y = XCANFA
Variable name and observations for X1 = FAD
      :
      :
      :
Variable name and observations for X26 = ANTL1

```

DATA

NOTE : In a free format (i.e. without a FORMAT statement), input/output data consist of a string of values separated by at least one blank (the symbol _ represents one blank). If this type of format is not available on some computers, one can easily change it into a formatted input/output (see main program and subroutine FCN for modifications).

The sample deck structure above is illustrated without the NGRID option.

To use this option, one must proceed in two steps :

- 1) Run normally the program with NSTORE=1 and NGRID=0, and save the function and parameters values from TAPE3 on a file named MAXLOG; simply add in the control statements section, after card LGO(PL=20000) :

```
REWIND(TAPE3)
LIB(C,TAPE3,N=MAXLOG)
```

- 2) To obtain a grid for β_1 and β_4 , for example, card type no. (18) must be added at the end of the data section :

```
BETA_1
BETA_4
BE_1_0.25
EL_1
BE_4_0,025
EL_2
```

Run the program with NSTORE=2 and NGRID=1. A slight modification in the control statements section is required. The two cards after LGO(PL=20000) are no longer useful and they must be deleted. Two new cards are required after FTN card, to connect the file MAXLOG to the program :

```
LIB(L,TAPE3,N=MAXLOG)
REWIND(TAPE3)
```

Note that unformatted (binary) READ or WRITE is used on TAPE3.

PRINT-OUT

SCARD1

NOBS = 181,
NC = 13,
NF = 178,
NFP = 181,
NOBEL = 12,
NM = 0,
NSTEP = 100,
EPSI = .1E-06,
SEND

SCARD2

NB = 26,
NRO = 2,
NSL = 14,
NGF = 0,
MAXF = 0,
NGV = 5,
MAXV = 3,
NLY = 1,
NDH = 1,
NLE = 1,
ND = 1,
SEND

SCARD3

NCOR = 2,
NRES = 2,
NPW = 2,
NGUVW = 1,
NPDQL = 2,
NCOV = 1,
NSTORE = 0,
NGRID = 0,
SEND

WORKING SPACE USED : 13798

AUTOCORRELATION OF ORDERS 1 12
INITIAL VALUES FOR RHOS 0. 0.

GROUP (X) WITHOUT BOX-COX TRANSFORMATION
VARIABLE NO. 8 9 10 11 13 15 16 17 18 19 20 21 25 26

GROUP 1 INITIAL VALUE FOR LAMBDA(X) 1.
VARIABLE NO. 1 2 3

GROUP 2 INITIAL VALUE FOR LAMBDA(X) 1.
VARIABLE NO. 4

GROUP 3 INITIAL VALUE FOR LAMBDA(X) 1.
VARIABLE NO. 5 6 7

GROUP 4 INITIAL VALUE FOR LAMBDA(X) 1.
VARIABLE NO. 12 14

GROUP 5 INITIAL VALUE FOR LAMBDA(X) 1.
VARIABLE NO. 22 23 24

INITIAL VALUE FOR LAMBDA(Y) 1.
UPPER LIMIT FOR Y 0.

HETEROSCEDASTICITY
INITIAL VALUES FOR DELTAS 0.
INITIAL VALUES FOR LAMBDA(S(E)) 1.
VARIABLE NO. 14

MEANS OF ORIGINAL VARIABLES COMPUTED FROM THE SUBSET OF POSITIVE OBSERVATIONS		NUMBER OF POSITIVE OBSERVATIONS	SCALING FACTORS (POWERS OF 10)
XCANFA	.2033392E+08	181	7
1 FAD	.1634673E+00	181	0
2 NC	.3046819E+06	181	5
3 P	.1393586E+03	181	2
4 RAVEM	.7874157E+02	181	1
5 TW	.3919595E+01	181	0
6 TT	.2147617E+02	181	1
7 T2T	.1001378E+02	181	1
8 TLK	.1946111E+03	180	2
9 PFK	.7225757E+00	179	0
10 SEK	.4913224E+01	96	0
11 CSEMP	.4655368E+02	95	1
12 CANEP	.1241095E+09	181	8
13 PCUTP	.2334263E+05	172	4
14 SHONE	.2094588E+06	181	5
15 EX7	.2611922E+07	7	6
16 EX3	.6866020E+06	6	5
17 EX9	.5944373E+06	4	5
18 EX0	.5145238E+06	4	5
19 EX1	.4598918E+06	4	5
20 STR	.1466667E+02	3	1
21 ZA	.8096551E-01	109	-1
22 WD	.2081768E+02	181	1
23 SAT	.4316866E+01	181	0
24 SHD	.5270718E+01	181	0
25 ANT	.1000000E+01	1	0
26 ANTL1	.1000000E+01	1	0

CORRELATION MATRIX

FAO	1.0000																										
NO	.9093	1.0000																									
P	.9441	.9900	1.0000																								
RAVEN	.8277	.9013	.9758	1.0000																							
TU	.8216	.9125	.9105	.9271	1.0000																						
FT	-.8163	-.7717	-.8034	-.7450	-.6479	1.0000																					
LE	.8055	.7710	.7644	.7356	.6756	.7167	1.0000																				
TL	-.0172	-.0260	-.0141	-.0095	-.1071	.0757	-.0021	1.0000																			
REF	-.0197	-.0255	-.0341	-.0139	.0787	-.0034	-.0496	-.6005	1.0000																		
SEP	-.0251	-.0816	-.0643	-.1010	-.1613	.1491	.0467	.7900	-.5507	1.0000																	
CHIMP	-.0469	-.0655	-.0523	-.0541	-.1514	.1434	.0225	.7668	-.5961	.7351	1.0000																
EALP	.0111	.0140	.0209	.0047	-.1856	.0635	-.0783	.0840	-.1705	.1407	.1509	1.0000															
RCUP	.4455	.4682	.4739	.4913	.1577	-.2010	.3668	.3562	-.3391	.3172	.3652	.4122	1.0000														
SHIMP	.1313	.4165	.4017	.3450	.1331	-.2491	.1703	-.0755	.0342	.0175	-.2564	.2314	.2927	1.0000													
ENP	.1911	.1097	.1210	.0391	-.0194	-.2618	-.0300	-.1208	.0274	-.1246	-.1337	-.0068	-.1616	.0774	1.0000												
EN3	.1592	.1040	.1016	.1466	.1535	-.1305	.0943	-.1529	.0749	-.1252	-.1707	-.0207	-.1118	.0187	-.0132	1.0000											
EN9	.2527	.1896	.2127	.1510	.2068	-.2152	.1674	-.0297	.1228	-.1012	-.1056	-.1474	-.1256	.0025	-.0156	.0187	1.0000										
EN0	.2433	.2339	.2514	.2402	.2046	-.2145	.2824	-.0914	.0451	-.1039	-.1005	-.1915	-.1157	.0241	-.0276	.0187	.0132	1.0000									
EN1	.2152	.2503	.2732	.3122	.2776	-.2043	.3835	-.1173	.0856	-.0909	-.1032	-.2487	-.1124	.0416	-.0157	.0187	.0132	.0132	1.0000								
STP	.0327	.0611	.0582	.0471	.0253	-.0078	-.0448	-.1147	-.0155	-.0310	-.0350	.1136	.0152	.0696	.2261	.0187	.0132	.0132	.0132	1.0000							
ZA	-.0192	-.0176	-.0503	-.0029	-.6053	.7133	-.6439	-.0525	.0963	.0008	-.0226	-.1706	-.4270	-.3716	-.2146	.0187	.0132	.0132	.0132	.0132	1.0000						
WD	.0063	.0154	.0091	.0344	.0221	-.0551	.0113	-.1216	.0701	-.1497	-.0169	-.1905	-.1573	-.1653	.0674	.0187	.0132	.0132	.0132	.0132	.0132	1.0000					
SAT	-.0053	.0070	.0917	.0034	.0890	-.0077	-.0148	-.0617	.0816	-.0723	-.0820	-.0940	-.0709	.0527	-.0152	.0187	.0132	.0132	.0132	.0132	.0132	.0132	1.0000				
SHD	-.0161	-.0179	-.0165	-.0642	.0027	.0130	-.0125	-.0353	.0251	-.0219	-.1972	.0545	.0479	.4081	-.0511	.0187	.0132	.0132	.0132	.0132	.0132	.0132	.0132	1.0000			
AUF	-.0107	-.0061	-.0234	-.0050	-.0419	.0593	-.0750	.0522	-.1126	-.0167	.1055	.0177	.0385	-.0275	-.0144	.0187	.0132	.0132	.0132	.0132	.0132	.0132	.0132	.0132	1.0000		
AVILL	-.0140	-.0053	-.0209	-.0042	-.1353	.0194	-.0765	-.0179	.0102	-.0543	-.0163	.0254	.0346	.0179	-.0144	.0187	.0132	.0132	.0132	.0132	.0132	.0132	.0132	.0132	.0132	1.0000	
NOVA	.1315	-.0025	-.1311	-.2164	-.1111	-.0321	-.1729	.0915	-.1240	.0996	.1420	.1815	-.0907	.0467	.5117	.0187	.0132	.0132	.0132	.0132	.0132	.0132	.0132	.0132	.0132	.0132	1.0000

FAO RE P RAVEN TU FT LE LEX REF SEP CHIMP EALP RCUP SHIMP ENP

CORRELATION MATRIX

E40	1.0000												
E43	-.0291	1.0000											
E46	-.0260	-.0218	1.0000										
E41	-.0255	-.0206	-.0211	1.0000									
STR	-.0234	-.0109	-.0195	-.0135	1.0000								
ZA	-.2007	-.1896	-.1732	-.1843	-.0571	1.0000							
WD	.0565	.0490	.0726	.0757	-.0068	.0044	1.0000						
SAT	.0173	.0000	-.0033	.0040	-.0319	.0151	-.4519	1.0000					
SND	-.0411	-.0093	-.0495	-.0461	.0163	.0733	-.5065	.2162	1.0000				
ANT	-.0140	-.0113	-.0116	-.0110	-.0192	.0727	.1673	-.0563	-.1274	1.0000			
ANTLI	-.0140	-.0113	-.0116	-.0110	-.0192	.0423	-.0635	-.0563	.0707	-.0261	1.0000		
NOCHA	.0574	-.0033	-.1309	-.1250	-.5016	.0716	.1176	-.0174	-.0111	.0811	.0310	1.0000	
E40	E43	E46	E41	STR	ZA	WD	SAT	SND	ANT	ANTLI	NOCHA		

COUSTION : KCANFA

VARIABLE	LANDMARK TYPL	GROUP	COEFFICIENT	MEAN(X)	STD-ERROR	STUDENT-T	ELASTIC(S) (OBS. NO.	ELASTIC(S) 13 - 178)	ELASTIC(S) (OBS. NO.	ELASTIC(S) 187 - 178)
1 IAD	EL	1	-.1405314E+01	.1652917E+00	.5170591E+00	-2.7179	-.1140	-.1140	-.1453	-.1652
2 NC	EL	1	-.2041061E+00	.3110110E+01	.8579959E-01	-2.3813	-.3143	-.3143	-.4936	-.4933
3 P	EL	1	.3984150E+00	.1431701E+01	.5614604E+00	.7096	.2761	.2761	.3410	.3408
4 RAVEM	EL	2	.1460379E+00	.7923125E+01	.3970514E-01	3.6923	.5756	.5756	.7611	.7626
5 TW	EL	3	-.1606342E+00	.1903221E+01	.3148151E-01	-5.0366	-.3336	-.3336	-.4375	-.4372
6 IT	EL	3	-.4506552E+00	.2143306E+01	.5297437E-01	-8.5079	-.4775	-.4775	-.4533	-.4531
7 YZT	EL	3	-.5864659E+00	.9928416E+00	.1894690E+00	-3.0953	-.2878	-.2878	-.3568	-.3566
8 TLK	NL	0	-.2395035E-02	.1931623E+01	.6473781E-02	-.3701	-.0027	-.0027	-.0025	-.0025
9 RFX	NL	0	-.3175002E-01	.7177446E+00	.1143923E-01	-2.7930	-.0113	-.0113	-.0102	-.0102
10 SFX	NL	0	-.3282802E-02	.2659754E+01	.2187014E-02	-1.5011	-.0043	-.0043	-.0073	-.0072
11 CSFMR	NL	0	.1496381E-01	.2512711E+01	.2427543E-02	6.1642	.0186	.0186	.0278	.0274
12 EAPFP	EL	4	.2370003E+00	.1275272E+01	.3627923E-01	6.4246	.1423	.1423	.1433	.1432
13 RCUTP	NL	0	.1321125E-01	.2291015E+01	.4451535E-02	2.9578	.0149	.0149	.0299	.0298
14 SHORF	EL	4	.7130467E-01	.2104270E+01	.1115237E-01	6.3937	.0742	.0742	.0924	.0923
15 EX7	NL	0	.2538359E+00	.1131413E+00	.1006761E-01	25.2081	.0138	.0138	0.0000	0.0000
16 EX3	NL	0	.2601995E-01	.2481034E+00	.3770514E-02	6.9009	.0032	.0032	0.0000	0.0000
17 EX9	NL	0	.2909708E-01	.1432379E+00	.5266730E-02	3.8159	.0014	.0014	0.0000	0.0000
18 IAD	NL	0	.1555659E-01	.1229816E+00	.6198723E-02	2.5096	.0010	.0010	0.0000	0.0000
19 LAL	NL	0	.1640191E-01	.1198173E+00	.7374725E-02	2.2241	.0009	.0009	.0133	.0132
20 SIR	NL	0	-.7278980E+00	.2650042E+01	.2170201E-01	-33.5406	-.0095	-.0095	0.0000	0.0000
21 ZA	NL	0	.5057853E-01	.4756768E+00	.2746302E-01	1.8467	.0119	.0119	0.0000	0.0030
22 AD	EL	5	.5350781E+00	.2082530E+01	.6247567E-01	8.5646	.5507	.5507	.5877	.5874
23 SAT	EL	5	.1555617E-01	.4343373E+01	.1050209E-01	3.3601	.0763	.0763	.0812	.0812
24 IAD	EL	5	.3621602E-01	.5255440E+01	.7583234E-02	4.7758	.0942	.0942	.1002	.1002
25 INT	NL	0	-.9727227E-01	.6024070E+02	.5708384E-01	-1.7031	-.0003	-.0003	0.0000	0.0000
26 ANTLI	NL	0	.8752566E-01	.6024070E+02	.5659798E-01	1.1931	.0002	.0002	0.0000	0.0000
27 CONSTANT	NL	0	-.9415267E+00	.1000308E+01	.5505159E+00	-1.7103	-.4653	-.4653	-.4964	-.4761

	V	E(V)	V-E(V)	V**	E(V**)	H**B	V**E(V**)	V**V**B
13	.2229E+01	.2208E+01	-.2164E-01	.1229E+01	.1278E+01	.1208E+01	-.2164E-01	-.2164E-01
14	.2174E+01	.2218E+01	-.4407E-01	.1174E+01	.1218E+01	.1218E+01	-.4407E-01	-.4407E-01
15	.2151E+01	.2193E+01	-.4224E-01	.1151E+01	.1193E+01	.1193E+01	-.4224E-01	-.4224E-01
16	.2158E+01	.2137E+01	.2134E-01	.1158E+01	.1137E+01	.1137E+01	.2134E-01	.2134E-01
17	.2101E+01	.2176E+01	-.6644E-02	.1101E+01	.1176E+01	.1176E+01	-.6644E-02	-.6644E-02
18	.2142E+01	.2156E+01	-.1456E-01	.1142E+01	.1156E+01	.1156E+01	-.1456E-01	-.1456E-01
19	.2092E+01	.2079E+01	.1320E-01	.1092E+01	.1079E+01	.1079E+01	.1320E-01	.1320E-01
20	.1990E+01	.1945E+01	.5956E-02	.9905E+00	.9845E+00	.9845E+00	.5956E-02	.5956E-02
21	.1938E+01	.1959E+01	-.1214E+00	.9378E+00	.1059E+01	.1059E+01	-.1214E+00	-.1214E+00
22	.1937E+01	.2031E+01	-.1014E-01	.9866E+00	.1091E+01	.1091E+01	-.1014E-01	-.1014E-01
23	.2102E+01	.2153E+01	-.5017E-01	.1102E+01	.1153E+01	.1153E+01	-.5017E-01	-.5017E-01
24	.2020E+01	.2084E+01	-.6462E-01	.1020E+01	.1084E+01	.1084E+01	-.6462E-01	-.6462E-01
25	.2149E+01	.2161E+01	-.1137E-01	.1149E+01	.1161E+01	.1161E+01	-.1137E-01	-.1137E-01
26	.2071E+01	.2127E+01	-.5643E-01	.1071E+01	.1127E+01	.1127E+01	-.5643E-01	-.5643E-01
27	.2036E+01	.2072E+01	-.3590E-01	.1036E+01	.1072E+01	.1072E+01	-.3590E-01	-.3590E-01
28	.2168E+01	.2200E+01	-.3244E-01	.1168E+01	.1200E+01	.1200E+01	-.3244E-01	-.3244E-01
29	.2136E+01	.2123E+01	.7801E-02	.1136E+01	.1123E+01	.1123E+01	.7801E-02	.7801E-02
30	.2116E+01	.2112E+01	.3373E-02	.1116E+01	.1112E+01	.1112E+01	.3373E-02	.3373E-02
31	.2050E+01	.2019E+01	.3020E-01	.1050E+01	.1019E+01	.1019E+01	.3020E-01	.3020E-01
32	.1912E+01	.1911E+01	.1892E-01	.9123E+00	.9123E+00	.9123E+00	.1892E-01	.1892E-01
33	.1807E+01	.1941E+01	-.1403E-01	.8971E+00	.9411E+00	.9411E+00	-.1403E-01	-.1403E-01
34	.2030E+01	.2068E+01	-.3877E-01	.1030E+01	.1068E+01	.1068E+01	-.3877E-01	-.3877E-01
35	.2138E+01	.2100E+01	.3547E-01	.1138E+01	.1100E+01	.1100E+01	.3547E-01	.3547E-01
36	.2111E+01	.2041E+01	.9597E-01	.1111E+01	.1041E+01	.1041E+01	.9597E-01	.9597E-01
37	.2037E+01	.2127E+01	-.1002E+00	.1037E+01	.1127E+01	.1127E+01	-.1002E+00	-.1002E+00
38	.2084E+01	.2056E+01	.2801E-01	.1084E+01	.1056E+01	.1056E+01	.2801E-01	.2801E-01
39	.2113E+01	.2026E+01	.8651E-01	.1113E+01	.1026E+01	.1026E+01	.8651E-01	.8651E-01
40	.2116E+01	.2261E+01	-.5114E-01	.1116E+01	.1261E+01	.1261E+01	-.5114E-01	-.5114E-01
41	.2097E+01	.2030E+01	.6671E-01	.1097E+01	.1030E+01	.1030E+01	.6671E-01	.6671E-01
42	.2124E+01	.2069E+01	.5467E-01	.1124E+01	.1069E+01	.1069E+01	.5467E-01	.5467E-01
43	.2059E+01	.1999E+01	.6006E-01	.1059E+01	.9999E+00	.9999E+00	.6006E-01	.6006E-01
44	.1819E+01	.1821E+01	-.2277E-02	.8194E+00	.8277E+00	.8277E+00	-.2277E-02	-.2277E-02
45	.1900E+01	.2021E+01	-.1222E-01	.9815E+00	.1022E+01	.1022E+01	-.1222E-01	-.1222E-01
46	.1966E+01	.2023E+01	-.5667E-01	.9661E+00	.1023E+01	.1023E+01	-.5667E-01	-.5667E-01
47	.2065E+01	.2010E+01	.5524E-01	.1065E+01	.1010E+01	.1010E+01	.5524E-01	.5524E-01
48	.2106E+01	.2046E+01	.6027E-01	.1106E+01	.1046E+01	.1046E+01	.6027E-01	.6027E-01
49	.2160E+01	.2135E+01	-.2467E-01	.1160E+01	.1135E+01	.1135E+01	-.2467E-01	-.2467E-01
50	.2006E+01	.2053E+01	-.4755E-01	.1006E+01	.1053E+01	.1053E+01	-.4755E-01	-.4755E-01
51	.1991E+01	.1930E+01	.5259E-01	.9907E+00	.9307E+00	.9307E+00	.5259E-01	.5259E-01
52	.2256E+01	.2146E+01	.1109E+00	.1256E+01	.1146E+01	.1146E+01	.1109E+00	.1109E+00
53	.2012E+01	.1973E+01	.3724E-01	.1012E+01	.9730E+00	.9730E+00	.3724E-01	.3724E-01
54	.2113E+01	.2081E+01	.3014E-01	.1113E+01	.1083E+01	.1083E+01	.3014E-01	.3014E-01
55	.2218E+01	.1965E+01	.2762E-01	.1218E+01	.9652E+00	.9652E+00	.2762E-01	.2762E-01
56	.1977E+01	.1810E+01	.1667E-01	.9772E+00	.8100E+00	.8100E+00	.1667E-01	.1667E-01
57	.1945E+01	.1965E+01	-.1427E-01	.9461E+00	.9652E+00	.9652E+00	-.1427E-01	-.1427E-01
58	.1910E+01	.2070E+01	-.1877E-01	.9305E+00	.1020E+01	.1020E+01	-.1877E-01	-.1877E-01
59	.2079E+01	.2070E+01	.1769E-01	.1079E+01	.1070E+01	.1070E+01	.1769E-01	.1769E-01
60	.2117E+01	.2090E+01	.1949E-01	.1117E+01	.1090E+01	.1090E+01	.1949E-01	.1949E-01
61	.2161E+01	.2116E+01	.4455E-01	.1161E+01	.1116E+01	.1116E+01	.4455E-01	.4455E-01
62	.2087E+01	.2137E+01	-.5022E-01	.1087E+01	.1137E+01	.1137E+01	-.5022E-01	-.5022E-01
63	.1976E+01	.2259E+01	-.2663E-01	.9959E+00	.1029E+01	.1029E+01	-.2663E-01	-.2663E-01
64	.2295E+01	.2259E+01	.3604E-01	.1295E+01	.1259E+01	.1259E+01	.3604E-01	.3604E-01
65	.2020E+01	.1985E+01	.2344E-01	.1008E+01	.9846E+00	.9846E+00	.2344E-01	.2344E-01
66	.2117E+01	.2166E+01	-.4939E-01	.1117E+01	.1166E+01	.1166E+01	-.4939E-01	-.4939E-01
67	.1971E+01	.1938E+01	.2284E-01	.9839E+00	.9581E+00	.9581E+00	.2284E-01	.2284E-01
68	.1779E+01	.1777E+01	.1892E-01	.7794E+00	.7773E+00	.7773E+00	.1892E-01	.1892E-01
69	.1926E+01	.2000E+01	-.6377E-01	.9358E+00	.9966E+00	.9966E+00	-.6377E-01	-.6377E-01
70	.1861E+01	.1961E+01	-.1022E+00	.8611E+00	.9615E+00	.9615E+00	-.1022E+00	-.1022E+00
71	.2079E+01	.2076E+01	.2734E-02	.1079E+01	.1076E+01	.1076E+01	.2734E-02	.2734E-02
72	.2117E+01	.2081E+01	.3416E-01	.1117E+01	.1081E+01	.1081E+01	.3416E-01	.3416E-01
73	.1979E+01	.2055E+01	-.7617E-01	.9787E+00	.1055E+01	.1055E+01	-.7617E-01	-.7617E-01
74	.2190E+01	.2060E+01	.1309E-01	.1190E+01	.1060E+01	.1060E+01	.1309E-01	.1309E-01

PLOT OF RESIDUALS W = V** - H**B



75	.1942E+01	.1907E+01	-.4167E-01	.9410E+00	.9874E+00	.9834E+00	-.4167E-01	-.4167E-01
76	.2161E+01	.2161E+01	.1777E-03	.1161E+01	.1161E+01	.1161E+01	.3065E-03	.3065E-03
77	.2017E+01	.2021E+01	.1171E-02	.1017E+01	.1021E+01	.1021E+01	-.4106E-02	-.4106E-02
78	.2076E+01	.2061E+01	.1270E-01	.1076E+01	.1067E+01	.1067E+01	.1270E-01	.1270E-01
79	.1093E+01	.1091E+01	.1074E-01	.8932E+00	.8825E+00	.8825E+00	.1074E-01	.1074E-01
80	.1044E+01	.1071E+01	.1149E-01	.8445E+00	.8330E+00	.8330E+00	.1149E-01	.1149E-01
81	.1007E+01	.1912E+01	-.2465E-01	.8071E+00	.9117E+00	.9117E+00	-.2465E-01	-.2465E-01
82	.1905E+01	.1952E+01	-.4714E-01	.9047E+00	.9519E+00	.9519E+00	-.4714E-01	-.4714E-01
83	.2139E+01	.2194E+01	.2613E-01	.1139E+01	.1104E+01	.1104E+01	.2613E-01	.2613E-01
84	.2023E+01	.1977E+01	.1287E-01	.1023E+01	.9968E+00	.9968E+00	.2023E-01	.2023E-01
85	.2059E+01	.2064E+01	-.4091E-02	.1059E+01	.1064E+01	.1064E+01	.4091E-02	.4091E-02
86	.2027E+01	.2025E+01	.6155E-01	.1027E+01	.1025E+01	.1025E+01	.6155E-01	.6155E-01
87	.2027E+01	.1972E+01	.5444E-01	.1027E+01	.9723E+00	.9723E+00	.5444E-01	.5444E-01
88	.2121E+01	.2162E+01	.5997E-01	.1121E+01	.1062E+01	.1062E+01	.5997E-01	.5997E-01
89	.2044E+01	.2054E+01	.2063E-01	.1044E+01	.1054E+01	.1054E+01	.2063E-01	.2063E-01
90	.2016E+01	.2050E+01	-.3119E-01	.1016E+01	.1050E+01	.1050E+01	-.3119E-01	-.3119E-01
91	.2004E+01	.1907E+01	.1811E-01	.9579E+00	.9871E+00	.9871E+00	.1811E-01	.1811E-01
92	.1860E+01	.1845E+01	.1111E-01	.8579E+00	.8408E+00	.8408E+00	.1111E-01	.1111E-01
93	.1902E+01	.1937E+01	.3106E-01	.9026E+00	.9355E+00	.9355E+00	.3106E-01	.3106E-01
94	.1995E+01	.2066E+01	-.7018E-01	.9952E+00	.1068E+01	.1068E+01	-.7018E-01	-.7018E-01
95	.2126E+01	.2121E+01	.4912E-02	.1126E+01	.1121E+01	.1121E+01	.4912E-02	.4912E-02
96	.2107E+01	.2067E+01	.4443E-01	.1107E+01	.1067E+01	.1067E+01	.4443E-01	.4443E-01
97	.2154E+01	.2159E+01	.4557E-01	.1154E+01	.1109E+01	.1109E+01	.4557E-01	.4557E-01
98	.2024E+01	.2027E+01	.1277E-03	.1024E+01	.1027E+01	.1027E+01	.1277E-03	.1277E-03
99	.2107E+01	.1907E+01	.1229E-05	.1107E+01	.9869E+00	.9869E+00	.1229E-05	.1229E-05
100	.2144E+01	.2144E+01	.1229E-05	.1144E+01	.1144E+01	.1144E+01	.1229E-05	.1229E-05
101	.2114E+01	.2114E+01	.1211E-05	.1114E+01	.1114E+01	.1114E+01	.1211E-05	.1211E-05
102	.2031E+01	.2051E+01	-.4959E-01	.1031E+01	.1051E+01	.1051E+01	-.4959E-01	-.4959E-01
103	.9477E+00	.1149E+00	.1289E-01	.5229E-03	.6509E-01	.6509E-01	.1289E-01	.1289E-01
104	.1754E+01	.1946E+01	-.2203E-01	.7847E+00	.8064E+00	.8064E+00	-.2203E-01	-.2203E-01
105	.1816E+01	.1961E+01	.7143E-01	.8157E+00	.9063E+00	.9063E+00	.7143E-01	.7143E-01
106	.1849E+01	.1961E+01	.7143E-01	.8157E+00	.9063E+00	.9063E+00	.7143E-01	.7143E-01
107	.2050E+01	.2015E+01	-.9024E-02	.1005E+01	.9629E+00	.9629E+00	-.9024E-02	-.9024E-02
108	.2050E+01	.2050E+01	-.2921E-02	.1053E+01	.1015E+01	.1015E+01	-.2921E-02	-.2921E-02
109	.1991E+01	.2107E+01	-.1104E-00	.9917E+00	.1109E+01	.1109E+01	-.1104E-00	-.1104E-00
110	.1946E+01	.1934E+01	-.3810E-01	.9461E+00	.9842E+00	.9842E+00	-.3810E-01	-.3810E-01
111	.1025E+01	.1025E+01	-.9712E-01	.8246E+00	.9217E+00	.9217E+00	-.9712E-01	-.9712E-01
112	.2074E+01	.2162E+01	.8917E-01	.1074E+01	.1163E+01	.1163E+01	.8917E-01	.8917E-01
113	.1970E+01	.1761E+01	.1594E+00	.9200E+00	.7606E+00	.7606E+00	.1594E+00	.1594E+00
114	.1956E+01	.1977E+01	-.4107E-01	.9563E+00	.9974E+00	.9974E+00	-.4107E-01	-.4107E-01
115	.1919E+01	.1800E+01	.2144E-01	.9191E+00	.8877E+00	.8877E+00	.2144E-01	.2144E-01
116	.1715E+01	.1690E+01	.2565E-01	.7151E+00	.6895E+00	.6895E+00	.2565E-01	.2565E-01
117	.1937E+01	.1871E+01	.3574E-01	.9070E+00	.8713E+00	.8713E+00	.3574E-01	.3574E-01
118	.1879E+01	.1780E+01	.1530E+00	.8788E+00	.9876E+00	.9876E+00	.1530E+00	.1530E+00
119	.2141E+01	.2130E+01	.1127E-01	.1141E+01	.1130E+01	.1130E+01	.1127E-01	.1127E-01
120	.2264E+01	.2210E+01	.5127E-01	.1264E+01	.1210E+01	.1210E+01	.5127E-01	.5127E-01
121	.2223E+01	.2252E+01	-.2985E-01	.1223E+01	.1252E+01	.1252E+01	-.2985E-01	-.2985E-01
122	.2203E+01	.2202E+01	.1822E-02	.1203E+01	.1202E+01	.1202E+01	.1822E-02	.1822E-02
123	.1957E+01	.2022E+01	-.6456E-01	.9572E+00	.1022E+01	.1022E+01	-.6456E-01	-.6456E-01
124	.2247E+01	.2226E+01	.2960E-01	.1247E+01	.1226E+01	.1226E+01	.2960E-01	.2960E-01
125	.2303E+01	.2130E+01	.1454E+00	.1283E+01	.1138E+01	.1138E+01	.1454E+00	.1454E+00
126	.3029E+01	.2976E+01	.4264E-01	.2023E+01	.1938E+01	.1938E+01	.4264E-01	.4264E-01
127	.2097E+01	.2090E+01	-.9065E-01	.1097E+01	.1090E+01	.1090E+01	-.9065E-01	-.9065E-01
128	.2050E+01	.2042E+01	.1594E-01	.1050E+01	.1042E+01	.1042E+01	.1594E-01	.1594E-01
129	.1911E+01	.2144E+01	-.3139E-01	.2144E+01	.2144E+01	.2144E+01	-.3139E-01	-.3139E-01
130	.1911E+01	.1852E+01	-.4173E-01	.1911E+01	.1852E+00	.1852E+00	-.4173E-01	-.4173E-01
131	.9550E+00	.9433E+00	.1191E-01	.8526E+00	.8526E+00	.8526E+00	.1191E-01	.1191E-01
132	.2107E+01	.2074E+01	.3245E-01	.1107E+01	.1074E+01	.1074E+01	.3245E-01	.3245E-01
133	.2050E+01	.2070E+01	-.4009E-01	.1050E+01	.1090E+01	.1090E+01	-.4009E-01	-.4009E-01
134	.2021E+01	.2020E+01	-.6785E-02	.1021E+01	.1020E+01	.1020E+01	-.6785E-02	-.6785E-02
135	.1910E+01	.1911E+01	-.9797E-03	.9102E+00	.9112E+00	.9112E+00	-.9797E-03	-.9797E-03
136	.2181E+01	.2080E+01	.7571E-01	.1181E+01	.1080E+01	.1080E+01	.7571E-01	.7571E-01
137	.2014E+01	.2000E+01	.1176E-01	.1014E+01	.9990E+00	.9990E+00	.1176E-01	.1176E-01
138	.2180E+01	.2174E+01	.5812E-02	.1180E+01	.1174E+01	.1174E+01	.5812E-02	.5812E-02



139	.2021E+01	.2067E+01	-.4161E-01	.1021E+01	.1067E+01	.1067E+01	-.4163E-01	-.4167E-01
140	.2037E+01	.2009E+01	.2810E-01	.1037E+01	.1009E+01	.1009E+01	.2415E-01	.2811E-01
141	.2154E+01	.2152E+01	.2191E-02	.1154E+01	.1152E+01	.1152E+01	.2189E-02	.2189E-02
142	.2081E+01	.2108E+01	-.2705E-01	.1081E+01	.1108E+01	.1108E+01	-.2705E-01	-.2705E-01
143	.2167E+01	.2090E+01	.7723E-01	.1167E+01	.1090E+01	.1090E+01	.7729E-01	.7727E-01
144	.2081E+01	.1981E+01	.9850E-01	.1081E+01	.9850E+00	.9850E+00	.9650E-01	.9950E-01
145	.2024E+01	.2040E+01	-.2137E-01	.1024E+01	.1040E+01	.1040E+01	-.1654E-01	-.1654E-01
146	.2015E+01	.2039E+01	.4223E-01	.1015E+01	.1039E+01	.1039E+01	.4223E-01	.4223E-01
147	.1974E+01	.1937E+01	.1801E-01	.0974E+01	.0937E+01	.0937E+01	.1801E-01	.1801E-01
148	.2074E+01	.2090E+01	-.2666E-01	.1074E+01	.1090E+01	.1090E+01	-.2666E-01	-.2666E-01
149	.1874E+01	.1874E+01	.4352E-01	.0874E+01	.0874E+01	.0874E+01	.4352E-01	.4352E-01
150	.1930E+01	.1874E+01	.1684E-01	.0930E+01	.0874E+01	.0874E+01	.1684E-01	.1684E-01
151	.1852E+01	.1874E+01	.3127E-01	.0852E+01	.0874E+01	.0874E+01	.3127E-01	.3127E-01
152	.1855E+01	.1855E+01	.0560E-00	.0855E+01	.0855E+01	.0855E+01	.0560E-00	.0560E-00
153	.1904E+01	.1920E+01	-.2370E-01	.0904E+01	.0920E+01	.0920E+01	-.2370E-01	-.2370E-01
154	.1870E+01	.1914E+01	.4396E-01	.0870E+01	.0914E+01	.0914E+01	.4396E-01	.4396E-01
155	.1979E+01	.1979E+01	.3975E-03	.0979E+01	.0979E+01	.0979E+01	.3975E-03	.3975E-03
156	.1870E+01	.1870E+01	.2464E-01	.0870E+01	.0870E+01	.0870E+01	.2464E-01	.2464E-01
157	.1926E+01	.1926E+01	.2498E-01	.0926E+01	.0926E+01	.0926E+01	.2498E-01	.2498E-01
158	.1875E+01	.1925E+01	.9976E-01	.0875E+01	.0925E+01	.0925E+01	.9976E-01	.9976E-01
159	.1809E+01	.1805E+01	.3827E-02	.0809E+01	.0805E+01	.0805E+01	.3827E-02	.3827E-02
160	.1930E+01	.1949E+01	-.1121E-01	.0930E+01	.0949E+01	.0949E+01	-.1121E-01	-.1121E-01
161	.1921E+01	.1895E+01	.2547E-01	.0921E+01	.0895E+01	.0895E+01	.2547E-01	.2547E-01
162	.1840E+01	.1873E+01	.7055E-02	.0840E+01	.0873E+01	.0873E+01	.7055E-02	.7055E-02
163	.1869E+01	.1809E+01	.2012E-01	.0869E+01	.0809E+01	.0809E+01	.2012E-01	.2012E-01
164	.1765E+01	.1740E+01	.9226E-02	.0765E+01	.0740E+01	.0740E+01	.9226E-02	.9226E-02
165	.1803E+01	.1791E+01	.2518E-01	.0803E+01	.0791E+01	.0791E+01	.2518E-01	.2518E-01
166	.1847E+01	.1899E+01	.5122E-01	.0847E+01	.0899E+01	.0899E+01	.5122E-01	.5122E-01
167	.1902E+01	.1919E+01	-.1700E-01	.0902E+01	.0919E+01	.0919E+01	-.1700E-01	-.1700E-01
168	.1894E+01	.1300E+01	.1280E-01	.0894E+01	.0300E+01	.0300E+01	.1280E-01	.1280E-01
169	.1992E+01	.2011E+01	-.5985E-01	.0992E+01	.1011E+01	.1011E+01	-.5985E-01	-.5985E-01
170	.1819E+01	.1879E+01	.3927E-01	.0819E+01	.0879E+01	.0879E+01	.3927E-01	.3927E-01
171	.1800E+01	.1840E+01	.4301E-02	.0800E+01	.0840E+01	.0840E+01	.4301E-02	.4301E-02
172	.2107E+01	.2001E+01	.2147E-01	.1107E+01	.1001E+01	.1001E+01	.2147E-01	.2147E-01
173	.1923E+01	.1908E+01	.3001E-01	.0923E+01	.0908E+01	.0908E+01	.3001E-01	.3001E-01
174	.1882E+01	.1861E+01	.2877E-01	.0882E+01	.0861E+01	.0861E+01	.2877E-01	.2877E-01
175	.1896E+01	.1867E+01	.7373E-02	.0896E+01	.0867E+01	.0867E+01	.7373E-02	.7373E-02
176	.1757E+01	.1750E+01	.1075E-01	.0757E+01	.0750E+01	.0750E+01	.1075E-01	.1075E-01
177	.1842E+01	.1852E+01	-.0421E-01	.0842E+01	.0852E+01	.0852E+01	-.0421E-01	-.0421E-01
178	.1844E+01	.1897E+01	-.5311E-01	.0844E+01	.0897E+01	.0897E+01	-.5311E-01	-.5311E-01

PROBABILITY OF Y NOT TO BE AT THE LIMIT = 1.0000

MEAN (Y) : 2.0233914

E(Y) AT THE MEANS : 2.0233902

MEAN (Y**3) : 1.0233914

PSEUDO-(E)-R2 : .9539578

PSEUDO-(L)-R2 : .9539578

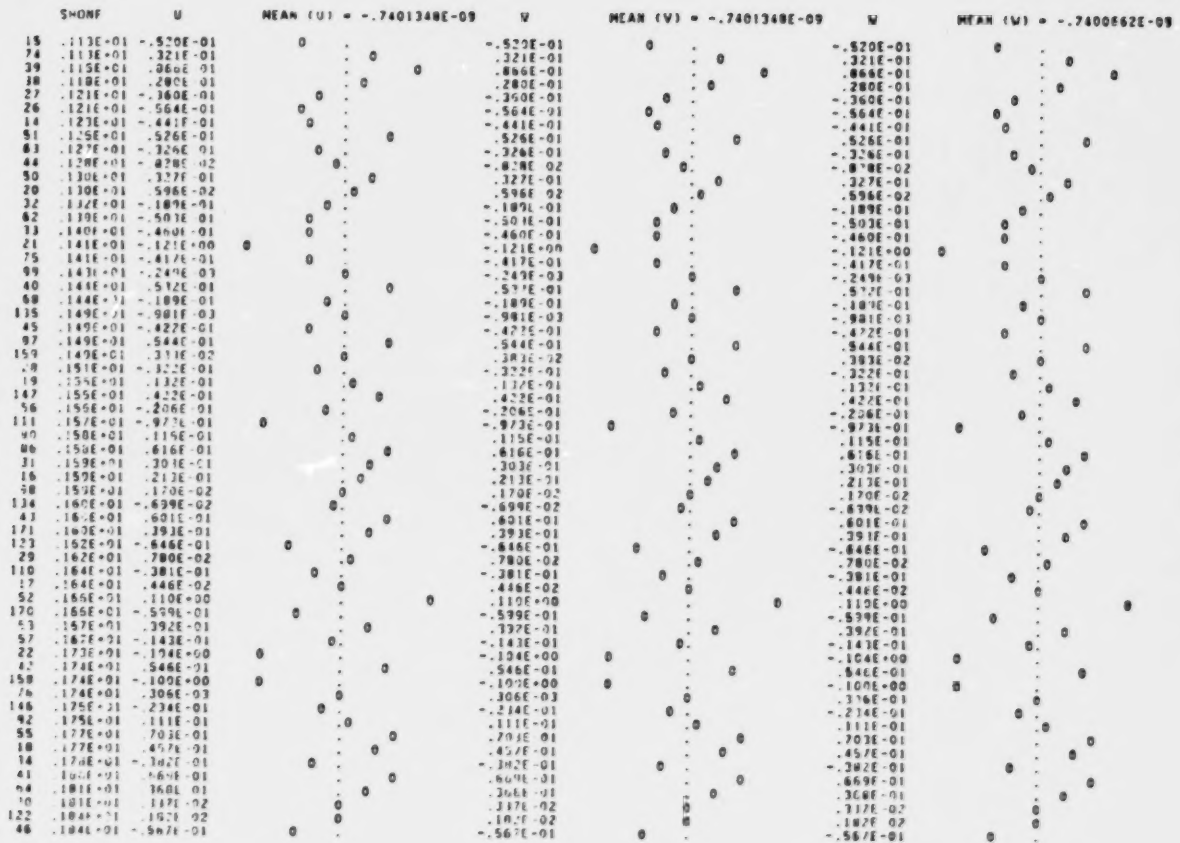
ERROR VARIANCE : .2392319E-02



RESIDUALS (W) LISTED BY MONTHS

	1	2	3	4	5	6	7	8	9	10	11	12
1956	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1957	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	.216E-01
1958	-.441E-01	-.520E-01	.213E-01	.446E-02	.457E-01	.132E-01	.596E-02	-.121E+00	-.104E+00	-.602E-01	-.566E-01	-.113E-01
1959	-.564E-01	-.360E-01	-.322E-01	.709E-02	.337E-02	.303E-01	-.107E-01	-.460E-01	-.382E-01	.355E-01	.960E-01	.100E+00
1960	.220E-01	.066E-01	.532E-01	.669E-01	.546E-01	.601E-01	-.028E-02	-.422E-01	-.567E-01	.552E-01	.603E-01	.747E-01
1961	.327E-01	.526E-01	.110E+00	.392E-01	.301E-01	.703E-01	-.206E-01	-.143E-01	-.897E-01	-.107E-01	.195E-01	-.931E-01
1962	-.503E-01	-.326E-01	.366E-01	.236E-01	.110E-01	.220E-01	-.189E-01	-.630E-01	-.102E+00	.273E-02	.344E-01	-.651E-01
1963	.321E-01	-.417E-01	.306E-03	-.411E-02	.128E-01	.107E-01	.115E-01	-.246E-01	-.471E-01	.281E-01	.207E-01	-.436E-01
1964	.616E-01	.544E-01	.590E-01	.297E-01	-.334E-01	.161E-01	.111E-01	-.339E-01	-.704E-01	.491E-02	.444E-01	.456E-01
1965	.170E-02	-.249E-03	-.746E-09	-.741E-09	-.498E-01	.120E-01	-.220E-01	-.704E-01	-.730E-01	-.902E-02	-.292E-02	-.110E+00
1966	-.381E-01	-.973E-01	-.892E-01	.159E+00	-.411E-01	.315E-01	.256E-01	.357E-01	-.109E+00	.112E-01	.533E-01	-.200E-01
1967	.102E-02	-.646E-01	.206E-01	.145E+00	.427E-01	-.908E-03	.159E-01	-.334E-01	-.417E-01	.119E-01	.325E-01	-.471E-01
1968	-.639E-02	-.901E-03	.759E-01	.130E-01	.561E-02	-.416E-01	.201E-01	.219E-02	-.270E-01	.773E-01	.985E-01	-.165E-01
1969	-.234E-01	.422E-01	-.100E-01	-.267E-01	.435E-01	.160E-01	.313E-01	-.237E-01	-.440E-01	.396E-03	.246E-01	-.250E-01
1970	-.100E+00	.383E-02	-.112E-01	.264E-01	.705E-02	-.201E-01	.252E-01	.922E-02	-.517E-01	-.170E-01	.139E-01	-.197E-01
1971	-.590E-01	.373E-01	.214E-01	.480E-02	.308E-01	.200E-01	.737E-02	-.103E-01	-.531E-01			

PLOTS OF RESIDUALS (U,V,W) AROUND THEIR MEANS



88 .196E-01 .590E-01
79 .186E-01 .107E-01
93 .186E-01 .333E-01
104 .187E-01 .229E-01
65 .187E-01 .239E-01
105 .187E-01 .704E-01
50 .143E-01 .097E-01
100 .104E-01 .746E-09
23 .199E-01 .632E-01
54 .197E-01 .101E-01
47 .192E-01 .542E-01
140 .192E-01 .241E-01
116 .192E-01 .256E-01
91 .193E-01 .161E-01
69 .194E-01 .638E-01
172 .191E-01 .214E-01
67 .195E-01 .270E-01
152 .195E-01 .313E-01
86 .196E-01 .110E-01
59 .197E-01 .107E-01
89 .197E-01 .297E-01
160 .199E-01 .112E-01
91 .199E-01 .246E-01
79 .200E-01 .107E-00
35 .200E-01 .355E-01
165 .201E-01 .922E-02
164 .203E-01 .252E-01
103 .203E-01 .120E-01
77 .205E-01 .411E-02
128 .206E-01 .157E-01
116 .206E-01 .757E-01
153 .207E-01 .237E-01
78 .207E-01 .124E-01
112 .207E-01 .092E-01
82 .208E-01 .471E-01
149 .209E-01 .180E-01
36 .209E-01 .980E-01
40 .211E-01 .601E-01
24 .212E-01 .564E-01
77 .214E-01 .193E-01
161 .214E-01 .264E-01
90 .216E-01 .334E-01
141 .216E-01 .219E-02
117 .217E-01 .357E-01
71 .217E-01 .277E-02
102 .216E-01 .496E-01
94 .210E-01 .704E-01
142 .220E-01 .270E-01
83 .221E-01 .761E-01
176 .222E-01 .737E-02
137 .222E-01 .139E-01
179 .225E-01 .416E-01
149 .225E-01 .267E-01
101 .225E-01 .741E-09
114 .228E-01 .411E-01
129 .230E-01 .331E-01
154 .230E-01 .443E-01
166 .231E-01 .517E-01
124 .234E-01 .206E-01
106 .234E-01 .747E-01
151 .237E-01 .168E-01
80 .238E-01 .195E-01
115 .236E-01 .315E-01
138 .237E-01 .561E-02

.794E-01
.107E-01
.333E-01
.229E-01
.239E-01
.704E-01
.107E-01
.697E-01
.746E-09
.601E-01
.501E-01
.542E-01
.241E-01
.256E-01
.161E-01
.638E-01
.214E-01
.270E-01
.313E-01
.110E-01
.107E-01
.297E-01
.112E-01
.246E-01
.107E-00
.355E-01
.922E-02
.252E-01
.120E-01
.411E-02
.157E-01
.757E-01
.237E-01
.124E-01
.092E-01
.471E-01
.180E-01
.980E-01
.601E-01
.564E-01
.193E-01
.264E-01
.334E-01
.219E-02
.357E-01
.277E-02
.496E-01
.704E-01
.270E-01
.761E-01
.737E-02
.139E-01
.416E-01
.267E-01
.741E-09
.411E-01
.331E-01
.443E-01
.517E-01
.206E-01
.747E-01
.168E-01
.195E-01
.315E-01
.561E-02

.590E-01
.107E-01
.333E-01
.229E-01
.239E-01
.704E-01
.107E-01
.697E-01
.746E-09
.601E-01
.501E-01
.542E-01
.241E-01
.256E-01
.161E-01
.638E-01
.214E-01
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.107E-01
.297E-01
.112E-01
.246E-01
.107E-00
.355E-01
.922E-02
.252E-01
.120E-01
.411E-02
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.564E-01
.193E-01
.264E-01
.334E-01
.219E-02
.357E-01
.277E-02
.496E-01
.704E-01
.270E-01
.761E-01
.737E-02
.139E-01
.416E-01
.267E-01
.741E-09
.411E-01
.331E-01
.443E-01
.517E-01
.206E-01
.747E-01
.168E-01
.195E-01
.315E-01
.561E-02

143 .239E+01 .773E-01
125 .241E+01 .145E+00
113 .241E+01 .159E+00
127 .242E+01 -.908E-03
126 .243E+01 .427E-01
171 .247E+01 .480E-02
162 .247E+01 .705E-02
170 .251E+01 -.531E-01
150 .257E+01 .415E-01
95 .254E+01 .491E-02
187 .257E+01 -.170E-01
107 .258E+01 -.902E-02
175 .258E+01 .200E-01
72 .259E+01 .342E-01
131 .260E+01 .119E-01
174 .261E+01 .306E-01
119 .265E+01 .112E-01
130 .266E+01 -.417E-01
163 .267E+01 -.201E-01
13 .270E+01 .210E-01
84 .270E+01 .207E-01
96 .271E+01 .441E-01
155 .271E+01 .370E-03
118 .273E+01 -.109E+00
37 .274E+01 .103E+00
75 .274E+01 -.113E-01
150 .282E+01 .119E-01
156 .281E+01 .246E-01
49 .282E+01 .247E-01
144 .298E+01 .905E-01
140 .304E+01 -.292E-02
91 .305E+01 -.991E-01
73 .316E+01 -.661E-01
120 .321E+01 .513E-01
45 .339E+01 -.405E-02
122 .343E+01 .325E-01
97 .357E+01 .453E-01
145 .359E+01 -.165E-01
169 .368E+01 -.110E+00
157 .409E+01 -.250E-01
123 .416E+01 -.401E-01
121 .425E+01 -.203E-01
169 .436E+01 -.197E-01

.773E-01
.145E+00
.159E+00
-.908E-03
.427E-01
.480E-02
.705E-02
-.531E-01
.415E-01
.491E-02
-.170E-01
-.902E-02
.200E-01
.342E-01
.119E-01
.306E-01
.112E-01
-.417E-01
-.201E-01
.210E-01
.207E-01
.441E-01
.370E-03
-.109E+00
.103E+00
-.113E-01
.119E-01
.246E-01
.247E-01
.905E-01
-.292E-02
-.991E-01
-.661E-01
.513E-01
-.405E-02
.325E-01
.453E-01
-.165E-01
-.110E+00
-.250E-01
-.401E-01
-.203E-01
-.197E-01

.773E-01
.145E+00
.159E+00
-.908E-03
.427E-01
.480E-02
.705E-02
-.531E-01
.415E-01
.491E-02
-.170E-01
-.902E-02
.200E-01
.342E-01
.119E-01
.306E-01
.112E-01
-.417E-01
-.201E-01
.210E-01
.207E-01
.441E-01
.370E-03
-.109E+00
.103E+00
-.113E-01
.119E-01
.246E-01
.247E-01
.905E-01
-.292E-02
-.991E-01
-.661E-01
.513E-01
-.405E-02
.325E-01
.453E-01
-.165E-01
-.110E+00
-.250E-01
-.401E-01
-.203E-01
-.197E-01

ANALYSIS OF RESIDUALS

AUTOCORRELATION AND PARTIAL AUTOCORRELATION FUNCTIONS

No. 166

DIFFERENCE		LAGS		AUTOCORRELATIONS										STD-ERROR	
(1-B) ⁰ (1-B) ¹²															
VAR =	.2392E-02	1-12	.29	.07	.10	.06	.02	.01	.04	-.02	.01	-.06	.06	.37	.08
		13-24	-.02	-.22	-.12	-.08	-.09	-.10	-.07	-.15	-.14	-.22	-.08	.11	.09
		25-36	-.05	-.29	-.10	-.03	-.04	-.06	-.04	-.10	-.09	-.07	.04	.21	.11

```

A001(1,12) - 5 GROUPS OF LAMBD(A) - 1 LAMBD(A) - 1 DELTA - 1 LAMBD(A)
0. 10 100 .1E+01 1E-06
0. 1000E+01 0. 10000E+01 10000E+01 10000E+01 10000E+01 10000E+01 10000E+01 0. 10000E+01 10000E+01
0. 1000E+01 0. 10000E+01 10000E+01 10000E+01 10000E+01 10000E+01 10000E+01 0. 10000E+01 10000E+01
0. 1000E+01 0. 10000E+01 10000E+01 10000E+01 10000E+01 10000E+01 10000E+01 0. 10000E+01 10000E+01
FIRST ENTRY TO FCN . PARAMETERS OF CURRENT STEP FOLLOW - F,X(1)
-.26542044E+03 0. 0. 10000E+01 10000E+01 10000E+01 10000E+01 10000E+01 10000E+01 10000E+01
NEW ABSOLUTE MINIMUM . PARAMETERS FOR FCN ENTRY 6 FOLLOW - F,X(1)
-.2975015464E+03 .37758E+03 .52152E+00 .10120E+01 .99595E+00 .10031E+01 .97845E+00 .99410E+00 .93650E+00
-.29745E-01 10000E+01
NEW ABSOLUTE MINIMUM . PARAMETERS FOR FCN ENTRY 10 FOLLOW - F,X(1)
-.3011594380E+03 .16121E+00 .77091E+00 .10521E+01 .98209E+00 .95713E+00 .98630E+00 .96901E+00 .10235E+01
-.15639E+00 10000E+01
NEW ABSOLUTE MINIMUM . PARAMETERS FOR FCN ENTRY 13 FOLLOW - F,X(1)
-.3023210944E+03 .11806E+00 .83211E+00 .13062E+01 .89291E+00 .73091E+00 .11519E+01 .86407E+00 .87845E+00
-.29554E+00 10000E+01
NEW ABSOLUTE MINIMUM . PARAMETERS FOR FCN ENTRY 17 FOLLOW - F,X(1)
-.305709584E+03 .15099E+00 .94675E+00 .21142E+01 .60669E+00 -.32043E-02 .17686E+01 .53182E+00 .98474E+00
-.57045E+00 10000E+01
NEW ABSOLUTE MINIMUM . PARAMETERS FOR FCN ENTRY 20 FOLLOW - F,X(1)
-.3065374935E+03 .10719E+00 .10201E+01 .23292E+01 .52305E+00 -.23721E+00 .19349E+01 .43000E+00 .97255E+00
-.47006E+00 10000E+01
NEW ABSOLUTE MINIMUM . PARAMETERS FOR FCN ENTRY 23 FOLLOW - F,X(1)
-.3080249514E+03 .17191E+00 .10206E+01 .23249E+01 .44832E+00 -.95307E+00 .19374E+01 .11223E+00 .96711E+00
-.52511E+00 10000E+01
NEW ABSOLUTE MINIMUM . PARAMETERS FOR FCN ENTRY 26 FOLLOW - F,X(1)
-.3005634297E+03 .15144E+00 .10430E+01 .18972E+01 .49160E+00 -.13855E+01 .20958E+01 -.17147E+00 .94932E+00
-.38875E+00 10000E+01
NEW ABSOLUTE MINIMUM . PARAMETERS FOR FCN ENTRY 29 FOLLOW - F,X(1)
-.3087420946E+03 .15994E+00 .10121E+01 .20479E+01 .32275E+00 -.19407E+01 .18451E+01 -.26773E+00 .94981E+00
-.32816E+00 10000E+01
NEW ABSOLUTE MINIMUM . PARAMETERS FOR FCN ENTRY 32 FOLLOW - F,X(1)
-.3084242009E+03 .10530E+00 .93180E+00 .21385E+01 .23804E+00 -.20030E+01 .17240E+01 -.29582E+00 .97343E+00
-.40071E+00 10000E+01
NEW ABSOLUTE MINIMUM . PARAMETERS FOR FCN ENTRY 34 FOLLOW - F,X(1)
-.3028489572E+03 .19008E+00 .91410E+00 .21424E+01 .24274E+00 -.20705E+01 .17249E+01 -.33850E+00 .95581E+00
-.46107E+00 10000E+01
NEW ABSOLUTE MINIMUM . PARAMETERS FOR FCN ENTRY 37 FOLLOW - F,X(1)
-.308727775E+03 .18159E+00 .97060E+00 .21255E+01 .70866E+00 -.21143E+01 .18096E+01 -.41543E+00 .95710E+00
-.59390E+00 10000E+01
NEW ABSOLUTE MINIMUM . PARAMETERS FOR FCN ENTRY 39 FOLLOW - F,X(1)
-.3083800732E+03 .18457E+00 .92140E+00 .21739E+01 .37482E+00 -.20847E+01 .17782E+01 -.34011E+00 .96230E+00
-.70231E+00 10000E+01

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NEW ABSOLUTE MINIMUM . PARAMETERS FOR FCN ENTRY 41 FOLLOW - - F.X(1)
 -.3000007781E+03 .18319E+00 .92616E+00 .21841E+01 .34873E+00 -.20735E+01 .17707E+01 -.33095E+00 .96008E+00
 .71363E+00 -.71613E+00

NEW ABSOLUTE MINIMUM . PARAMETERS FOR FCN ENTRY 43 FOLLOW - - F.X(1)
 -.3000009175E+03 .18346E+00 .92554E+00 .21590E+01 .34103E+00 -.20784E+01 .17667E+01 -.33094E+00 .96065E+00
 .71809E+00 -.71784E+00

NEW ABSOLUTE MINIMUM . PARAMETERS FOR FCN ENTRY 45 FOLLOW - - F.X(1)
 -.3000009892E+03 .18346E+00 .92554E+00 .21576E+01 .32971E+00 -.20741E+01 .17592E+01 -.33921E+00 .96062E+00
 .70849E+00 -.72461E+00

NEW ABSOLUTE MINIMUM . PARAMETERS FOR FCN ENTRY 47 FOLLOW - - F.X(1)
 -.3000009124E+03 .18325E+00 .92624E+00 .21555E+01 .32517E+00 -.20717E+01 .17639E+01 -.33787E+00 .96045E+00
 .70574E+00 -.72297E+00

NEW ABSOLUTE MINIMUM . PARAMETERS FOR FCN ENTRY 49 FOLLOW - - F.X(1)
 -.3000009024E+03 .18319E+00 .92638E+00 .21563E+01 .32699E+00 -.20717E+01 .17640E+01 -.33815E+00 .96054E+00
 .70602E+00 -.72454E+00

NEW ABSOLUTE MINIMUM . PARAMETERS FOR FCN ENTRY 51 FOLLOW - - F.X(1)
 -.30000090254E+03 .18324E+00 .92627E+00 .21569E+01 .32898E+00 -.20722E+01 .17636E+01 -.33828E+00 .96048E+00
 .70516E+00 -.72361E+00

NEW ABSOLUTE MINIMUM . PARAMETERS FOR FCN ENTRY 53 FOLLOW - - F.X(1)
 -.3030090254E+03 .18324E+00 .92629E+00 .21569E+01 .32911E+00 -.20722E+01 .17637E+01 -.33818E+00 .96050E+00
 .70508E+00 -.72333E+00

NEW ABSOLUTE MINIMUM . PARAMETERS FOR FCN ENTRY 54 FOLLOW - - F.X(1)
 -.3000090254E+03 .18324E+00 .92629E+00 .21569E+01 .32911E+00 -.20722E+01 .17637E+01 -.33817E+00 .96050E+00
 .70508E+00 -.72333E+00

NEW ABSOLUTE MINIMUM . PARAMETERS FOR FCN ENTRY 58 FOLLOW - - F.X(1)
 -.3030090254E+03 .18324E+00 .92629E+00 .21569E+01 .32911E+00 -.20722E+01 .17637E+01 -.33817E+00 .96050E+00
 .70508E+00 -.72333E+00

THE FUNCTION (FCN) WAS NOT IMPROVED BY .10000E-06 AFTER 3 STEPS WHICH INCLUDE A MINIMUM - - -

THEREFORE THE RUN HAS BEEN TERMINATED
 -.3000090254E+03 .18324E+00 .92629E+00 .21569E+01 .32911E+00 -.20722E+01 .17637E+01 -.33817E+00 .96050E+00
 .70508E+00 -.72333E+00

ALL NUMBERS OF LAST ENTRY REFER TO FINAL PT. OF RUN

THE LOWEST VALUE OF THE FUNCTION (FCN) WAS -.3000090254E+03 FOR ENTRY 58 - - X(1) FOLLOWS
 .18324E+00 .92629E+00 .21569E+01 .32911E+00 -.20722E+01 .17637E+01 -.33817E+00 .96050E+00 .70508E+00 -.72333E+00

RUN STATISTICS FOLLOW - -

NFCN= 58 NST= 21

	Y	E(Y)	Y-E(Y)	Y**	E(Y**)	Y**	Y**-[E(Y**)]	Y**-[E(Y**)]	PLOT OF RESIDUALS W = Y** - X**
13	.2229E+01	.2199E+01	-.2999E-01	.7790E-01	.5511E-01	.5511E-01	.2265E-01	.2265E-01	
14	.2174E+01	.2207E+01	-.3262E-01	.7334E-01	.1029E+00	.1029E+00	-.2955E-01	-.2955E-01	
15	.2051E+01	.2094E+01	-.4321E-01	.2407E-01	.6510E-01	.6510E-01	-.4027E-01	-.4027E-01	
16	.2339E+01	.2280E+01	.7019E-01	.1171E+00	.7409E-01	.7409E-01	.5507E-01	.5507E-01	
17	.2181E+01	.2170E+01	.1100E-01	.5311E-01	.4709E-01	.4709E-01	.9218E-02	.9218E-02	
18	.2242E+01	.2207E+01	.3491E-01	.7750E-01	.5700E-01	.5700E-01	.2470E-01	.2470E-01	
19	.2007E+01	.2077E+01	-.1412E-01	.8761E-01	.7042E-01	.7042E-01	.1220E-01	.1220E-01	
20	.1900E+01	.1945E+01	-.5607E-02	.3117E-01	.2800E-01	.2800E-01	.5020E-02	.5020E-02	
21	.1910E+01	.2010E+01	-.1010E-01	.4701E-01	.3311E-01	.3311E-01	.8014E-01	.8014E-01	
22	.1907E+01	.2010E+01	-.1099E-01	.1006E-01	.3605E-01	.3605E-01	.2569E-01	.2569E-01	
23	.2102E+01	.2106E+01	-.3352E-02	.2740E-01	.2519E-01	.2519E-01	.2706E-02	.2706E-02	
24	.2053E+01	.2066E+01	-.1012E-01	.4801E-01	.1701E-01	.1701E-01	.3071E-01	.3071E-01	
25	.2149E+01	.2161E+01	-.1117E-01	.4215E-01	.5055E-01	.5055E-01	.8400E-02	.8400E-02	
26	.2071E+01	.2067E+01	.1147E-02	.4542E-01	.5509E-01	.5509E-01	.1045E-01	.1045E-01	
27	.2016E+01	.1985E+01	.5044E-01	.5591E-01	.8711E-02	.8711E-02	.4612E-01	.4612E-01	
28	.2180E+01	.2175E+01	.6294E-02	.6164E-02	.7910E-01	.7910E-01	.5371E-02	.5371E-02	
29	.2176E+01	.2169E+01	.7340E-01	.5147E-01	.8154E-01	.8154E-01	.2805E-01	.2805E-01	
30	.2116E+01	.2157E+01	-.4153E-01	.3615E-02	.3036E-01	.3036E-01	.1737E-01	.1737E-01	
31	.2050E+01	.2073E+01	-.2054E-01	.4557E-01	.6294E-01	.6294E-01	.4107E-01	.4107E-01	
32	.1912E+01	.1957E+01	-.4611E-01	.6457E-02	.4757E-01	.4757E-01	.1265E-03	.1265E-03	
33	.1897E+01	.1897E+01	.0000E+00	.4157E-01	.4170E-01	.4170E-01	.1952E-01	.1952E-01	
34	.2030E+01	.2007E+01	.2247E-01	.1107E+00	.9218E-01	.9218E-01	.2499E-01	.2499E-01	
35	.2123E+01	.2099E+01	.2349E-01	.1059E+00	.7692E-01	.7692E-01	.8700E-01	.8700E-01	
36	.2119E+01	.2015E+01	.1045E+00	.1312E+00	.4822E-01	.4822E-01	.5107E-01	.5107E-01	
37	.2227E+01	.2159E+01	.6700E-01	.1239E+00	.8011E-01	.8011E-01	.2771E-01	.2771E-01	
38	.2094E+01	.2054E+01	.3910E-01	.1181E+00	.9054E-01	.9054E-01	.5312E-01	.5312E-01	
39	.2113E+01	.2055E+01	.5715E-01	.1617E+00	.1006E+00	.1006E+00	.3523E-01	.3523E-01	
40	.2118E+01	.2275E+01	-.4085E-01	.2272E+00	.1918E+00	.1918E+00	.3291E-01	.3291E-01	
41	.2097E+01	.2057E+01	.4007E-01	.2792E-02	.3530E-01	.3530E-01	.9012E-03	.9012E-03	
42	.2121E+01	.2127E+01	-.1074E-02	.1029E+00	.1011E+00	.1011E+00	.4609E-02	.4609E-02	
43	.2055E+01	.2054E+01	.5450E-02	.7900E-01	.7479E-01	.7479E-01	.2977E-01	.2977E-01	
44	.1819E+01	.2054E+01	-.2419E-01	.1371E+00	.1671E+00	.1671E+00	.2002E-01	.2002E-01	
45	.1940E+01	.2005E+01	-.1055E-01	.1926E-01	.4976E-01	.4976E-01	.3050E-01	.3050E-01	
46	.2065E+01	.2001E+01	.6463E-01	.5700E-01	.1947E-01	.1947E-01	.3711E-01	.3711E-01	
47	.2129E+01	.2147E+01	-.1771E-01	.7267E-01	.1011E+00	.1011E+00	.2940E-01	.2940E-01	
48	.2167E+01	.2167E+01	.0000E+00	.3503E-01	.3947E-01	.3947E-01	.4802E-02	.4802E-02	
49	.2085E+01	.2085E+01	.0000E+00	.8770E-01	.8707E-01	.8707E-01	.6299E-03	.6299E-03	
50	.1991E+01	.1986E+01	.4971E-02	.3934E-01	.3402E-01	.3402E-01	.4402E-02	.4402E-02	
51	.2256E+01	.2241E+01	.1555E-01	.6666E-01	.4465E-01	.4465E-01	.1271E-01	.1271E-01	
52	.2012E+01	.2050E+01	-.3880E-01	.4431E-03	.4732E-01	.4732E-01	.4609E-01	.4609E-01	
53	.2113E+01	.2151E+01	-.3772E-01	.7015E-01	.4100E+00	.4100E+00	.3048E-01	.3048E-01	
54	.2036E+01	.2037E+01	-.1042E-02	.3957E-01	.1006E+00	.1006E+00	.1510E-02	.1510E-02	
55	.1797E+01	.1628E+01	.1305E-01	.1194E-01	.1442E-01	.1442E-01	.2616E-01	.2616E-01	
56	.1794E+01	.1947E+01	-.1497E-01	.6424E-01	.5469E-01	.5469E-01	.3501E-03	.3501E-03	
57	.1970E+01	.1947E+01	.2319E-01	.3392E-01	.5210E-01	.5210E-01	.1318E-01	.1318E-01	
58	.2374E+01	.2205E+01	.1577E+00	.1035E+00	.1001E+00	.1001E+00	.4616E-02	.4616E-02	
59	.2117E+01	.2103E+01	.1467E-01	.7116E-01	.6404E-01	.6404E-01	.6578E-02	.6578E-02	
60	.2016E+01	.2107E+01	-.1061E-01	.3516E-01	.2071E-01	.2071E-01	.3406E-01	.3406E-01	
61	.2087E+01	.2124E+01	-.3714E-01	.1106E+00	.1416E+00	.1416E+00	.3407E-01	.3407E-01	
62	.1896E+01	.2211E+01	-.3215E-01	.7057E-01	.8094E-01	.8094E-01	.1334E-01	.1334E-01	
63	.2174E+01	.2272E+01	-.1048E-01	.1130E+00	.1157E+00	.1157E+00	.1812E-01	.1812E-01	
64	.2174E+01	.2272E+01	-.1048E-01	.1130E+00	.1157E+00	.1157E+00	.1812E-01	.1812E-01	
65	.2174E+01	.2272E+01	-.1048E-01	.1130E+00	.1157E+00	.1157E+00	.1812E-01	.1812E-01	
66	.2174E+01	.2272E+01	-.1048E-01	.1130E+00	.1157E+00	.1157E+00	.1812E-01	.1812E-01	
67	.2174E+01	.2272E+01	-.1048E-01	.1130E+00	.1157E+00	.1157E+00	.1812E-01	.1812E-01	
68	.2174E+01	.2272E+01	-.1048E-01	.1130E+00	.1157E+00	.1157E+00	.1812E-01	.1812E-01	
69	.2174E+01	.2272E+01	-.1048E-01	.1130E+00	.1157E+00	.1157E+00	.1812E-01	.1812E-01	
70	.2174E+01	.2272E+01	-.1048E-01	.1130E+00	.1157E+00	.1157E+00	.1812E-01	.1812E-01	
71	.2174E+01	.2272E+01	-.1048E-01	.1130E+00	.1157E+00	.1157E+00	.1812E-01	.1812E-01	
72	.2174E+01	.2272E+01	-.1048E-01	.1130E+00	.1157E+00	.1157E+00	.1812E-01	.1812E-01	
73	.2174E+01	.2272E+01	-.1048E-01	.1130E+00	.1157E+00	.1157E+00	.1812E-01	.1812E-01	
74	.2100E+01	.2037E+01	.6236E-01	.1993E+00	.1416E+00	.1416E+00	.5815E-01	.5815E-01	

75	-1942E+01	-1963E+01	-2116E-01	-1647E-01	.2017E-02	.2017E-02	-.1040E-01	-.1040E-01
76	-2161E+01	-2107E+01	-1870E-01	-3827E-01	.5376E-01	.5376E-01	-.1549E-01	-.1549E-01
77	-2017E+01	-2044E+01	-2712E-01	-2951E-01	.6115E-01	.6115E-01	-.2164E-01	-.2164E-01
78	-2076E+01	-2096E+01	-2050E-01	-5462E-01	.7093E-01	.7093E-01	-.1637E-01	-.1637E-01
79	-1003E+01	-1036E+01	-2999E-02	-2700E-02	-.2500E-03	-.2500E-03	-.2441E-02	-.2441E-02
80	-1044E+01	-1010E+01	-2642E-01	-9211E-01	.6961E-01	.6961E-01	.2253E-01	.2253E-01
81	-1067E+01	-1000E+01	-6790E-02	-3228E-01	.2600E-01	.2600E-01	.5487E-02	.5487E-02
82	-1905E+01	-1865E+01	-4009E-01	-8004E-01	.5603E-01	.5603E-01	.3201E-01	.3201E-01
83	-2130E+01	-2082E+01	-4817E-01	-1306E+00	.1000E+00	.1000E+00	.3780E-01	.3780E-01
84	-2026E+01	-2034E+01	-7793E-02	-4467E-02	.1424E-02	.1424E-02	-.5892E-02	-.5892E-02
85	-2059E+01	-2011E+01	-4791E-01	-1017E-00	.6673E-01	.6673E-01	.3501E-01	.3501E-01
86	-2006E+01	-2075E+01	-1151E-01	-3201E-01	.2306E-01	.2306E-01	.9750E-02	.9750E-02
87	-2027E+01	-1962E+01	-6497E-01	-1103E+00	.6236E-01	.6236E-01	.5594E-01	.5594E-01
88	-2121E+01	-2060E+01	-5209E-01	-5452E-01	.1208E-01	.1208E-01	.4244E-01	.4244E-01
89	-2054E+01	-2083E+01	-8173E-03	-1157E+00	.1150E+00	.1150E+00	.6666E-03	.6666E-03
90	-2016E+01	-2047E+01	-3011E-01	-2080E-01	.4467E-01	.4467E-01	.2377E-01	.2377E-01
91	-2003E+01	-1954E+01	-8010E-02	-1358E+00	.1285E+00	.1285E+00	.7137E-02	.7137E-02
92	-1866E+01	-1851E+01	-9175E-01	-4279E-01	.3517E-01	.3517E-01	.7621E-02	.7621E-02
93	-1903E+01	-1917E+01	-1433E-01	-8017E-01	.1009E+00	.1009E+00	.1170E-01	.1170E-01
94	-1995E+01	-1995E+01	-6317E-02	-1256E+00	.1207E+00	.1207E+00	.4984E-02	.4984E-02
95	-2126E+01	-2107E+01	-1659E-01	-7326E-01	.6049E-01	.6049E-01	.1277E-01	.1277E-01
96	-2107E+01	-2049E+01	-5816E-01	-1160E+00	.7200E-01	.7200E-01	.4399E-01	.4399E-01
97	-2154E+01	-2109E+01	-4556E-01	-1242E+00	.9114E-01	.9114E-01	.3316E-01	.3316E-01
98	-2028E+01	-2046E+01	-1759E-01	-4814E-01	.6301E-01	.6301E-01	.1487E-01	.1487E-01
99	-1967E+01	-1982E+01	-5831E-02	-5831E-01	.5405E-01	.5405E-01	.4251E-02	.4251E-02
100	-2144E+01	-2157E+01	-1473E-01	-1091E+00	.1206E+00	.1206E+00	.1151E-01	.1151E-01
101	-2114E+01	-2067E+01	-5195E-01	-6951E-01	.2866E-01	.2866E-01	.4067E-01	.4067E-01
102	-2001E+01	-2020E+01	-1829E-01	-4719E-01	.6161E-01	.6161E-01	.1442E-01	.1442E-01
103	-9477E+00	-9406E+00	-7160E-02	-7066E+00	.7926E+00	.7926E+00	.5924E-02	.5924E-02
104	-1795E+01	-1794E+01	-9363E-02	-7066E+00	.7926E+00	.7926E+00	.5924E-02	.5924E-02
105	-1036E+01	-1079E+01	-4300E-01	-2917E-01	.6437E-01	.6437E-01	.3573E-01	.3573E-01
106	-1609E+01	-1609E+01	-1017E-01	-2474E-02	.5595E-02	.5595E-02	.6067E-02	.6067E-02
107	-2006E+01	-2003E+01	-2319E-02	-1549E-01	.1371E-01	.1371E-01	.1703E-02	.1703E-02
108	-2050E+01	-2080E+01	-3004E-01	-3136E-01	.5265E-01	.5265E-01	.2279E-01	.2279E-01
109	-1991E+01	-2050E+01	-8699E-01	-3627E-01	.1213E-01	.1213E-01	.4841E-01	.4841E-01
110	-1946E+01	-1914E+01	-3257E-01	-3211E-01	.4687E-02	.4687E-02	.2742E-01	.2742E-01
111	-1625E+01	-1677E+01	-5273E-01	-6862E-01	.2409E-01	.2409E-01	.4453E-01	.4453E-01
112	-2074E+01	-2107E+01	-3261E-01	-5141E-01	.7734E-01	.7734E-01	.2593E-01	.2593E-01
113	-1920E+01	-1842E+01	-7657E-01	-7941E-01	.1380E+00	.1380E+00	.5933E-01	.5933E-01
114	-1956E+01	-1998E+01	-4154E-01	-4345E-01	.7593E-01	.7593E-01	.3247E-01	.3247E-01
115	-1919E+01	-1923E+01	-4273E-02	-6175E+00	.6200E+00	.6200E+00	.3312E-02	.3312E-02
116	-1715E+01	-1662E+01	-8762E-01	-1822E-01	.5503E-01	.5503E-01	.3862E-01	.3862E-01
117	-1977E+01	-1841E+01	-6596E-01	-1154E-00	.6323E-01	.6323E-01	.5222E-01	.5222E-01
118	-1879E+01	-1931E+01	-5236E-01	-3166E-01	.7134E-01	.7134E-01	.2967E-01	.2967E-01
119	-2141E+01	-2101E+01	-4020E-01	-1873E-00	.1567E+00	.1567E+00	.3055E-01	.3055E-01
120	-2064E+01	-2048E+01	-1536E-01	-2054E+00	.1941E+00	.1941E+00	.1170E-01	.1170E-01
121	-2073E+01	-2270E+01	-4777E-01	-1765E+00	.2095E+00	.2095E+00	.3336E-01	.3336E-01
122	-2203E+01	-2243E+01	-3354E-01	-2483E+00	.2805E+00	.2805E+00	.3219E-01	.3219E-01
123	-1957E+01	-1948E+01	-9737E-02	-1191E+00	.1109E+00	.1109E+00	.8229E-02	.8229E-02
124	-2247E+01	-2154E+01	-9274E-01	-1999E+00	.1279E+00	.1279E+00	.7189E-01	.7189E-01
125	-2023E+01	-2231E+01	-5173E-01	-2986E+00	.2588E+00	.2588E+00	.3984E-01	.3984E-01
126	-2029E+01	-2016E+01	-1220E-01	-8331E+00	.8239E+00	.8239E+00	.9263E-02	.9263E-02
127	-2097E+01	-2052E+01	-3206E-01	-6595E+00	.6840E+00	.6840E+00	.2443E-01	.2443E-01
128	-2050E+01	-2031E+01	-2639E-01	-7910E+00	.7705E+00	.7705E+00	.2053E-01	.2053E-01
129	-2111E+01	-2150E+01	-3869E-01	-8510E+00	.8809E+00	.8809E+00	.2990E-01	.2990E-01
130	-1611E+01	-1774E+01	-3672E-01	-1651E+00	.1931E+00	.1931E+00	.2803E-01	.2803E-01
131	-9550E+00	-9759E+00	-1995E-01	-7066E+00	.8023E+00	.8023E+00	.1570E-01	.1570E-01
132	-2107E+01	-2064E+01	-4713E-01	-1361E+00	.1054E+00	.1054E+00	.3055E-01	.3055E-01
133	-2050E+01	-2042E+01	-8400E-02	-3051E-01	.3655E-01	.3655E-01	.6042E-02	.6042E-02
134	-2021E+01	-2020E+01	-8920E-02	-1267E-01	.1852E-01	.1852E-01	.5847E-02	.5847E-02
135	-1910E+01	-1890E+01	-7010E-01	-4070E-01	.2341E-01	.2341E-01	.1729E-01	.1729E-01
136	-2161E+01	-2145E+01	-1813E-01	-7947E-01	.6504E-01	.6504E-01	.1442E-01	.1442E-01
137	-2014E+01	-2137E+01	-1271E+00	-9403E-01	.2497E-02	.2497E-02	.9652E-01	.9652E-01
138	-2180E+01	-2229E+01	-4054E-01	-3627E+00	.3252E+00	.3252E+00	.3751E-01	.3751E-01



139	.2021E+01	.2067E+01	-.4576E-01	-.4294E+00	-.3915E+00	-.3536E+00	-.3584E-01	-.3584E-01
140	.2037E+01	.2018E+01	.1904E-01	-.3407E+00	-.3962E+00	-.3962E+00	.1541E-01	.1541E-01
141	.2154E+01	.2124E+01	.3013E-01	-.4147E+00	-.4534E+00	-.4505E+00	.2175E-01	.2175E-01
142	.2081E+01	.2109E+01	.1255E-01	.2171E+00	.2239E+00	.2200E+00	.9875E-02	.9875E-02
143	.2167E+01	.2127E+01	.1255E-01	.2171E+00	.2239E+00	.2200E+00	.9875E-02	.9875E-02
144	.2501E+01	.2567E+01	.1477E-01	.5509E-01	.7475E+00	.7475E+00	.3600E-01	.3600E-01
145	.2024E+01	.2054E+01	-.7374E-01	.5307E-01	.7451E-01	.4541E-01	.1040E-01	.1040E-01
146	.2015E+01	.2041E+01	-.2507E-01	.7605E-01	.7476E-01	.9806E-01	-.2154E-01	-.2154E-01
147	.1974E+01	.1912E+01	.6105E-01	.1675E+00	.5471E-01	.5471E-01	-.2139E-01	-.2139E-01
148	.2072E+01	.2157E+01	-.1992E-01	.2777E-01	.9473E-01	.9473E-01	.5201E-01	.5201E-01
149	.1947E+01	.1667E+01	-.1992E-01	.2777E-01	.9473E-01	.9473E-01	.5201E-01	.5201E-01
150	.1970E+01	.1913E+01	.1705E-01	.7037E-01	-.5441E-01	-.5441E-01	-.1557E-01	-.1557E-01
151	.1892E+01	.1816E+01	.5670E-01	.1847E-01	-.8724E-01	-.8724E-01	.1343E-01	.1343E-01
152	.1056E+01	.1010E+01	.1845E-01	-.4576E-01	.6071E-01	.6071E-01	.4394E-01	.4394E-01
153	.1004E+01	.1950E+01	-.5435E-01	-.6791E-01	-.2453E-01	-.2453E-01	.1495E-01	.1495E-01
154	.1870E+01	.1806E+01	-.1329E-01	.7093E-01	-.6059E-01	-.6059E-01	.4339E-01	.4339E-01
155	.1979E+01	.1990E+01	-.1990E-01	-.1990E-01	-.2101E-01	-.2101E-01	.1024E-01	.1024E-01
156	.1878E+01	.1990E+01	-.1990E-01	-.1990E-01	-.2101E-01	-.2101E-01	.1905E-01	.1905E-01
157	.1974E+01	.1942E+01	-.1656E-01	.7179E-01	.1107E-01	.1107E-01	-.8965E-02	-.8965E-02
158	.1925E+01	.1345E+01	-.7027E-01	-.4745E-01	.1071E-01	.1071E-01	.1107E-01	.1107E-01
159	.1895E+01	.1895E+01	.3197E-02	-.3234E-01	-.3511E-01	-.3511E-01	.1052E-01	.1052E-01
160	.1938E+01	.1938E+01	.3234E-01	.6519E-02	.1953E-01	.1953E-01	.1180E-01	.1180E-01
161	.1921E+01	.1921E+01	-.9952E-02	.1676E+00	.1175E+00	.1175E+00	.2767E-02	.2767E-02
162	.1840E+01	.1911E+01	-.7915E-01	.4057E-02	.5311E-01	.5011E-01	.7879E-02	.7879E-02
163	.1869E+01	.1970E+01	-.3103E-01	.3743E-01	.6103E-01	.6103E-01	.5417E-01	.5417E-01
164	.1765E+01	.1751E+01	.7146E-02	-.1025E-01	.2463E-02	.2463E-02	.2367E-01	.2367E-01
165	.1807E+01	.1790E+01	.1231E-01	.7854E-02	.1691E-01	.1691E-01	.5767E-02	.5767E-02
166	.1847E+01	.1861E+01	-.1675E-01	.4707E-01	.6171E-01	.5171E-01	.9918E-02	.9918E-02
167	.1792E+01	.1971E+01	-.3218E-01	.3054E-01	.5518E-01	.5518E-01	.1269E-01	.1269E-01
168	.1894E+01	.1899E+01	-.5143E-02	.6692E-01	.7678E-01	.7078E-01	.2463E-01	.2463E-01
169	.1992E+01	.2037E+01	-.1573E-01	.9917E-01	.1103E+00	.1103E+00	.3681E-02	.3681E-02
170	.1839E+01	.1817E+01	.2923E-01	.7700E-01	.5447E-01	.5447E-01	.1112E-01	.1112E-01
171	.1839E+01	.1809E+01	.7203E-01	.1144E+00	.4053E-01	.4953E-01	.2458E-01	.2458E-01
172	.2103E+01	.2065E+01	.3701E-01	.2765E+00	.1760E+00	.1760E+00	.6686E-01	.6686E-01
173	.1973E+01	.1912E+01	.1070E-01	.1854E-01	.1071E-01	.1021E-01	.3052E-01	.3052E-01
174	.1805E+01	.1840E+01	.2012E-02	.7203E-01	.7126E-01	.7126E-01	.8325E-02	.8325E-02
175	.1876E+01	.1940E+01	.2015E-01	.8241E-01	.6100E-01	.6100E-01	.1565E-02	.1565E-02
176	.1757E+01	.1753E-01	-.1067E-02	.2544E-01	.7576E-01	.2626E-01	.2147E-01	.2147E-01
177	.1842E+01	.1857E-01	-.1497E-01	.9974E-01	.1065E+00	.1926E+00	.8254E-01	.8254E-01
178	.1844E+01	.1859E-01	-.1466E-01	.4713E-01	.5841E-01	.5841E-01	.1124E-01	.1124E-01

PROBABILITY OF Y NOT TO BE AT THE LIMIT = 1.0000

MEAN (Y) : 2.0233914
 E(Y) AT THE MEANS : 2.0299473
 MEAN (Y**) : .0588371
 PSEUDO-E(1)-P2 : .9727479
 PSEUDO-E(1)-P2 : .9727346
 ERROR VARIANCE : .9192078E-03

RESIDUALS (W) LISTED BY MONTHS

	1	2	3	4	5	6	7	8	9	10	11	12
1946	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1957	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1958	-.296E-01	-.403E-01	.591E-01	.922E-02	.287E-01	.122E-01	.802E-02	-.801E-01	-.257E-01	-.271E-02	-.302E-01	-.849E-02
1959	-.105E-01	.467E-01	-.577E-02	-.280E-01	-.340E-01	-.174E-01	-.411E-01	-.126E-03	.165E-01	.290E-01	.810E-01	.511E-01
1960	.277E-01	.531E-01	.353E-01	.329E-01	.901E-03	.461E-02	-.298E-01	-.208E-01	-.305E-01	.371E-01	-.294E-01	-.440E-02
1961	.670E-03	.448E-02	.123E-01	-.469E-01	-.305E-01	-.151E-02	-.264E-01	-.358E-03	-.113E-01	-.464E-02	.654E-02	-.641E-01
1962	-.329E-01	-.133E-01	.103E-01	-.152E-02	-.125E-01	-.281E-01	-.247E-01	-.375E-01	-.624E-02	.623E-02	.231E-01	-.450E-02
1963	.502E-01	-.185E-01	-.158E-01	-.216E-01	-.163E-01	.244E-02	.225E-01	.849E-02	.320E-01	.378E-01	-.589E-02	.350E-01
1964	.975E-02	.553E-01	.424E-01	.667E-03	-.238E-01	.714E-02	.752E-02	-.117E-01	.490E-02	.128E-01	.440E-01	.313E-01
1965	-.140E-01	.475E-02	-.115E-01	.407E-01	-.144E-01	.532E-02	-.765E-02	-.352E-01	-.807E-02	.178E-02	-.223E-01	-.434E-01
1966	.274E-01	-.445E-01	-.259E-01	.694E-01	-.325E-01	-.331E-02	.388E-01	.522E-01	-.397E-01	.306E-01	.113E-01	-.314E-01
1967	-.322E-01	.023E-02	.719E-01	.396E-01	.926E-02	-.244E-01	.205E-01	-.299E-01	.280E-01	.157E-01	.307E-01	.674E-02
1968	-.505E-02	.173E-01	.144E-01	-.965E-01	-.375E-01	-.358E-01	.154E-01	.238E-01	.980E-02	.360E-01	.105E-01	-.215E-01
1969	-.214E-01	.528E-01	-.672E-01	-.156E-01	.134E-01	.479E-01	.149E-01	-.434E-01	-.104E-01	-.198E-01	-.897E-02	-.118E-01
1970	-.504E-01	.277E-02	.260E-01	-.788E-02	-.542E-01	-.736E-01	.577E-02	.992E-02	-.127E-01	-.248E-01	-.388E-02	-.111E-01
1971	.240E-01	.669E-01	.305E-01	.832E-02	.158E-02	.215E-01	-.826E-01	-.119E-01	-.112E-01			

PLOTS OF RESIDUALS (U,V,W) AROUND THEIR MEANS

SHOWF	U	MEAN (U) = .0750058E-01	V	MEAN (V) = .7335875E-01	W	MEAN (W) = .7818860E-01
15	.113E+01	.167E+00	.160E+00	.120E+00	-.403E-01	.000E+00
74	.113E+01	.133E+00	.120E+00	.211E+00	.531E-01	.000E+00
39	.115E+01	.222E+00	.140E+00	.141E+00	.277E-01	.000E+00
30	.110E+01	.144E+00	.107E+00	.106E+00	.467E-01	.000E+00
27	.121E+01	.194E+00	.120E+00	.133E+00	-.105E-01	.000E+00
26	.121E+01	.113E+00	.107E+00	.106E+00	-.296E-01	.000E+00
14	.123E+01	.120E+00	.120E+00	.107E+00	.448E-02	.000E+00
51	.125E+01	.196E+00	.120E+00	.133E+00	-.171E-01	.000E+00
63	.127E+01	.145E+00	.107E+00	.106E+00	-.298E-01	.000E+00
44	.126E+01	.150E-01	.134E+00	.331E-01	.610E-03	.000E+00
50	.130E+01	.145E+00	.133E+00	.115E+00	.502E-02	.000E+00
20	.130E+01	.125E+00	.114E-02	.613E-01	-.411E-01	.000E+00
32	.112E+01	.871E-01	.770E-01	.114E-02	-.359E-01	.000E+00
92	.130E+01	.061E-01	.114E-02	.125E-01	-.124E-03	.000E+00
33	.140E+01	-.151E-01	.102E+00	.102E+00	-.801E-01	.000E+00
21	.141E+01	.149E+00	.133E+00	.133E+00	-.185E-01	.000E+00
75	.141E+01	.114E+00	.133E+00	.133E+00	.425E-02	.000E+00
99	.143E+01	.149E+00	.133E+00	.133E+00	.351E-01	.000E+00
40	.144E+01	.255E+00	.133E+00	.133E+00	-.247E-01	.000E+00
60	.144E+01	-.700E-02	.133E+00	.133E+00	.173E-01	.000E+00
135	.147E+01	.054E-01	.133E+00	.133E+00	-.270E-01	.000E+00
45	.149E+01	-.154E-01	.133E+00	.133E+00	.559E-01	.000E+00
87	.149E+01	.172E+00	.133E+00	.133E+00	.277E-02	.000E+00
157	.149E+01	.046E-01	.133E+00	.133E+00	-.537E-02	.000E+00
29	.151E+01	.279E+00	.133E+00	.133E+00	.127E-01	.000E+00
19	.155E+01	.155E+00	.133E+00	.133E+00	.524E-01	.000E+00
147	.155E+01	.126E+00	.133E+00	.133E+00	-.264E-01	.000E+00
56	.156E+01	.151E-01	.133E+00	.133E+00	-.445E-01	.000E+00
111	.157E+01	.076E-01	.133E+00	.133E+00	.225E-01	.000E+00
80	.156E+01	.204E-01	.133E+00	.133E+00	.975E-02	.000E+00
85	.158E+01	.139E+00	.133E+00	.133E+00	-.174E-01	.000E+00
31	.159E+01	.117E+00	.133E+00	.133E+00	.591E-01	.000E+00
16	.159E+01	.203E+00	.133E+00	.133E+00	-.145E-01	.000E+00
98	.159E+01	.112E+00	.133E+00	.133E+00	.585E-02	.000E+00
134	.160E+01	.456E-01	.133E+00	.133E+00	.461E-02	.000E+00
47	.163E+01	.113E+00	.133E+00	.133E+00	.669E-01	.000E+00
171	.160E+01	.130E+00	.133E+00	.133E+00	.823E-02	.000E+00
123	.162E+01	.011E-01	.133E+00	.133E+00	-.280E-01	.000E+00
29	.162E+01	.165E+00	.133E+00	.133E+00	.274E-01	.000E+00
110	.164E+01	.126E+00	.133E+00	.133E+00	.922E-02	.000E+00
17	.164E+01	.212E+00	.133E+00	.133E+00	.123E-01	.000E+00
52	.166E+01	.245E+00	.133E+00	.133E+00	.246E-01	.000E+00
170	.166E+01	-.765E-02	.133E+00	.133E+00	-.469E-01	.000E+00
53	.167E+01	.142E+00	.133E+00	.133E+00	.358E-03	.000E+00
57	.167E+01	-.909E-02	.133E+00	.133E+00	-.257E-01	.000E+00
22	.172E+01	.454E-01	.133E+00	.133E+00	.901E-03	.000E+00
42	.174E+01	.136E+00	.133E+00	.133E+00	-.594E-01	.000E+00
158	.174E+01	-.530E-01	.133E+00	.133E+00	-.195E-01	.000E+00
76	.174E+01	.172E+00	.133E+00	.133E+00	-.214E-01	.000E+00
146	.175E+01	.147E-01	.133E+00	.133E+00	.742E-02	.000E+00
92	.175E+01	.391E-01	.133E+00	.133E+00	-.151E-02	.000E+00
55	.177E+01	.101E+00	.133E+00	.133E+00	.207E-01	.000E+00
18	.177E+01	.197E+00	.133E+00	.133E+00	.185E-01	.000E+00
34	.178E+01	.554E-01	.133E+00	.133E+00	.379E-01	.000E+00
41	.180E+01	.211E+00	.133E+00	.133E+00	-.140E-01	.000E+00
64	.181E+01	.135E+00	.133E+00	.133E+00	-.327E-01	.000E+00
30	.181E+01	.135E+00	.133E+00	.133E+00	-.305E-01	.000E+00
122	.184E+01	.613E-01	.133E+00	.133E+00		
46	.184E+01	.129E-02	.133E+00	.133E+00		

88	.186E+01	.211E+00	.	.	.	.177E+00	.	.	.424E-01	.	.
79	.186E+01	.475E-01	.	.	.	.398E-01	.	.	-.244E-02	.	.
93	.186E+01	-.254E-01	.	.	.	-.222E-01	.	.	-.117E-01	.	.
104	.187E+01	.209E-01	.	.	.	.242E-01	.	.	-.765E-02	.	.
65	.187E+01	.147E+00	.	.	.	.123E+00	.	.	-.152E-02	.	.
105	.187E+01	-.561E-01	.	.	.	-.473E-01	.	.	-.352E-01	.	.
58	.188E+01	-.165E-01	.	.	.	-.138E-01	.	.	-.132E-01	.	.
100	.188E+01	.167E+00	.	.	.	.141E+00	.	.	-.115E-01	.	.
23	.190E+01	.940E-01	.	.	.	.784E-01	.	.	-.271E-02	.	.
84	.192E+01	.915E-01	.	.	.	.762E-01	.	.	-.305E-01	.	.
47	.192E+01	.128E+00	.	.	.	.106E+00	.	.	.371E-01	.	.
140	.192E+01	.724E-01	.	.	.	.602E-01	.	.	.154E-01	.	.
116	.193E+01	.747E-01	.	.	.	.622E-01	.	.	.338E-01	.	.
91	.193E+01	.500E-01	.	.	.	.416E-01	.	.	.714E-02	.	.
89	.194E+01	-.530E-01	.	.	.	-.447E-01	.	.	-.375E-01	.	.
172	.194E+01	.132E+00	.	.	.	.109E+00	.	.	-.281E-01	.	.
67	.195E+01	.554E-01	.	.	.	.453E-01	.	.	.305E-01	.	.
152	.195E+01	.781E-01	.	.	.	.647E-01	.	.	-.149E-01	.	.
66	.196E+01	.783E-01	.	.	.	.653E-01	.	.	-.125E-01	.	.
59	.197E+01	.847E-01	.	.	.	.707E-01	.	.	-.464E-02	.	.
89	.198E+01	.123E+00	.	.	.	.101E+00	.	.	.657E-03	.	.
160	.199E+01	.940E-01	.	.	.	.784E-01	.	.	.260E-01	.	.
81	.199E+01	-.274E-01	.	.	.	-.226E-01	.	.	.549E-02	.	.
70	.200E+01	-.296E-01	.	.	.	-.244E-01	.	.	-.624E-02	.	.
35	.200E+01	.115E+00	.	.	.	.946E-01	.	.	.20E-01	.	.
165	.201E+01	.104E-01	.	.	.	.157E-01	.	.	.917E-02	.	.
164	.201E+01	.636E-01	.	.	.	.523E-01	.	.	.577E-02	.	.
173	.203E+01	.513E-01	.	.	.	.427E-01	.	.	.513E-02	.	.
77	.203E+01	.111E+00	.	.	.	.744E-01	.	.	-.216E-01	.	.
120	.204E+01	.825E-01	.	.	.	.677E-01	.	.	.255E-01	.	.
136	.204E+01	.163E+00	.	.	.	.139E+00	.	.	.144E-01	.	.
153	.207E+01	-.548E-02	.	.	.	-.442E-02	.	.	-.434E-01	.	.
78	.207E+01	.590E-01	.	.	.	.434E-01	.	.	.153E-01	.	.
112	.207E+01	.119E+00	.	.	.	.902E-01	.	.	-.259E-01	.	.
82	.208E+01	.124E-01	.	.	.	.101E-01	.	.	.130E-01	.	.
140	.209E+01	.650E-01	.	.	.	.537E-01	.	.	-.672E-01	.	.
26	.209E+01	.224E+00	.	.	.	.183E+00	.	.	.830E-01	.	.
48	.211E+01	.151E+00	.	.	.	.124E+00	.	.	-.294E-01	.	.
24	.212E+01	.146E+00	.	.	.	.114E+00	.	.	-.302E-01	.	.
177	.214E+01	.895E-02	.	.	.	.735E-02	.	.	.119E-01	.	.
161	.214E+01	.494E-01	.	.	.	.402E-01	.	.	-.788E-02	.	.
90	.215E+01	.363E-01	.	.	.	.239E-01	.	.	-.238E-01	.	.
141	.216E+01	.460E-01	.	.	.	.374E-01	.	.	.218E-01	.	.
117	.217E+01	.361E-01	.	.	.	.233E-01	.	.	.522E-01	.	.
71	.217E+01	.651E-01	.	.	.	.531E-01	.	.	.623E-02	.	.
102	.218E+01	.404E-01	.	.	.	.328E-01	.	.	-.144E-01	.	.
24	.220E+01	.101E-01	.	.	.	.835E-02	.	.	.418E-02	.	.
142	.220E+01	.188E-01	.	.	.	.152E-01	.	.	.988E-02	.	.
33	.221E+01	.969E-01	.	.	.	.783E-01	.	.	.378E-01	.	.
175	.222E+01	.504E-01	.	.	.	.477E-01	.	.	-.826E-03	.	.
137	.222E+01	.899E-01	.	.	.	.719E-01	.	.	-.965E-010	.	.
119	.225E+01	-.308E-01	.	.	.	-.248E-01	.	.	-.358E-01	.	.
149	.225E+01	-.576E-01	.	.	.	.464E-01	.	.	-.156E-01	.	.
101	.225E+01	.174E+00	.	.	.	.140E+00	.	.	.407E-01	.	.
114	.228E+01	.295E-01	.	.	.	.237E-01	.	.	-.325E-01	.	.
129	.230E+01	.459E-02	.	.	.	.368E-02	.	.	-.299E-01	.	.
154	.230E+01	-.979E-04	.	.	.	-.795E-04	.	.	-.104E-01	.	.
166	.232E+01	-.123E-01	.	.	.	-.981E-02	.	.	-.127E-01	.	.
124	.234E+01	.188E+00	.	.	.	.150E+00	.	.	.719E-01	.	.
106	.234E+01	-.131E-01	.	.	.	-.105E-01	.	.	-.807E-02	.	.
151	.235E+01	.438E-01	.	.	.	.724E-01	.	.	.439E-01	.	.
60	.236E+01	.137E+00	.	.	.	.109E+00	.	.	.654E-02	.	.
115	.236E+01	.397E-01	.	.	.	.317E-01	.	.	-.331E-02	.	.
138	.237E+01	.261E-01	.	.	.	.298E-01	.	.	-.375E-01	.	.

143	.230E+01	.103E+00
125	.241E+01	.247E+00
117	.241E+01	.247E+00
112	.242E+01	.125E+01
126	.243E+01	.700E-01
116	.247E+01	.720E-01
106	.247E+01	-.257E-01
170	.251E+01	.170E-01
150	.251E+01	.470E-01
95	.254E+01	.907E-01
37	.257E+01	.356E-02
172	.258E+01	.661E-01
775	.259E+01	.216E-01
125	.259E+01	.170E-01
131	.260E+01	.761E-01
174	.261E+01	-.323E-02
160	.266E+01	-.770E-01
133	.267E+01	-.247E-02
163	.267E+01	-.02E-02
13	.270E+01	.259E-02
84	.270E+01	.116E+00
96	.271E+01	.150E+00
157	.271E+01	.515E-01
110	.273E+01	-.541E-01
37	.274E+01	.25E+00
25	.275E+01	.205E+00
168	.276E+01	.607E-01
156	.276E+01	.170E-01
49	.280E+01	.994E-01
144	.290E+01	.212E+00
108	.304E+01	.100E+00
61	.305E+01	.982E-01
73	.316E+01	.929E-01
120	.317E+01	.103E+00
85	.319E+01	.110E+00
112	.319E+01	-.31E-00
97	.350E+01	.174E+00
141	.359E+01	.357E-01
109	.359E+01	.013E-01
157	.409E+01	-.75E-01
133	.410E+01	.574E-01
121	.425E+01	.341E-01
169	.438E+01	.166E-01

0.822F-01
-1.177E+00
-1.177E+00
-0.994E-02
-6.71E-01
-0.00E+00
-1.199E-01
-1.171E-01
-3.370E-01
-7.14E-01
-0.00E+02
-0.00E+01
-1.185E-01
-1.117E+00
-5.96E-01
-2.253E-02
-6.08E-01
-0.00E+02
-3.47E-02
-2.01E+00
-0.02E-01
-1.21E+00
-4.01E-01
-0.00E+01
-2.02E+00
-1.59E+00
-4.75E-01
-5.97E-01
-0.00E+00
-9.97E-01
-7.65E-01
-7.50E-01
-7.05E-01
-7.01E-01
-0.00E+01
-9.34E-01
-1.19E+00
-2.26E-01
-6.04E-01
-7.1E-01
-8.2E-01
-2.44E-01
-1.21E-01

Figure 1 is a scatter plot with 'Days of Rain' on the horizontal axis (0 to 10) and 'Days of Sunshine' on the vertical axis (0 to 10). The data points are as follows:

Days of Rain	Days of Sunshine
1	9
2	8
3	7
4	6
5	5
6	4
7	3
8	2
9	1
10	0

0
- .360E-01
- .339E-01
- .594E-01
- - .244E-01
- .976E-02
- .813E-02
- -.547E-01
- -.113E-01
- .174E-01
- .120E-01
- -.249E-01
- .179E-02
- .215E-01
- .231E-01
- .157E-01
- .158E-02
- .306E-01
- .230E-01
- .276E-01
- .236E-01
- .567E-02
- .440E-01
- .199E-01
- .297E-01
0
- .511F-01
- .840E-02
- .380E-02
- -.097E-02
- .100E-02
- .109E-01
- .227E-01
- .641E-01
- .450E-02
- .113E-01
- .209F-01
- .307E-01
- .232E-01
- .215E-01
- .494E-01
- .18E-01
- .604E-02
- .374E-01
- .111E-01

ANALYSIS OF RESIDUALS

No. 166

AUTOCORRELATION AND PARTIAL AUTOCORRELATION FUNCTIONS

DIFFERENCE		LACS	AUTOCORRELATIONS												STD-ERROR
$\frac{(1-B)^0 (1-B)^{12}}{(1-B)^0 (1-B)^0}$															
VAR =	.9194E-03	1-12	.21	-.04	-.03	.03	-.09	-.07	.02	-.03	.10	-.01	.04	-.10	.08
		13-24	-.14	-.08	-.07	.04	-.06	-.10	-.01	-.07	-.06	-.11	.03	-.02	.08
		25-36	-.02	-.19	-.02	.04	-.02	.01	.01	-.02	-.05	-.07	-.05	.02	.03
DIFFERENCE		LACS	PARTIAL AUTOCORRELATIONS												STD-ERROR
$\frac{(1-B)^0 (1-B)^{12}}{(1-B)^0 (1-B)^0}$															
		1-12	.21	-.00	.02	.02	-.10	-.04	.05	.02	.10	-.06	.04	-.13	.08

COVARIANCE MATRIX OF THE PARAMETERS

[illegible]

- .56422E-01 .14988E+01 -.11553E+01 .11641E+01 -.41736E-01 -.13011E+02 .33327E+02
30 -.38123E-02 .70874E-05 .36281E-04 .14598E-04 .11133E-03 .11691E-03 -.39341E-04 .64292E-06 .10210E-05 -.17183E-08
.89722E-07 .67006E-05 .91149E-06 .70731E-05 .87188E-05 .47018E-06 .52569E-06 .12437E-07 -.18205E-06 -.11374E-04
.11904E-05 .46008E-04 .11849E-04 .16439E-04 -.41507E-07 -.22523E-05 -.16361E-02 .44720E-05 -.32487E-05 .11510E-03
.32832E-04 .59828E-04 -.23250E-03 -.20044E-04 .29046E-04 -.12442E-02 .23917E-02 .37665E-06

CORRELATION MATRIX

FAD	NC	P	RAVEN	TW	TT	T2T	TLK	RFX	SFK	CSFMR	EAHFP	RCUTP	SHO4F	ER7
1.0000														
-.0865	1.0000													
-.1024	.0000	1.0000												
-.7974	.5505	.5512	1.0000											
-.9419	.0512	.2120	.7300	1.0000										
-.6707	-.1402	-.0952	.4634	.6458	1.0000									
.1071	.0053	.7407	.3445	-.2304	-.3021	1.0000								
-.2100	.0246	.1094	.1933	.2230	.1470	.0237	1.0000							
.0510	-.0166	-.0305	-.0404	-.0225	-.0283	-.0170	-.2564	1.0000						
-.1498	-.0103	.0212	.1356	.1698	.1911	-.0709	.2565	-.1043	1.0000					
-.1930	-.0204	.0117	.2225	.1903	.2632	-.0911	.2114	-.1207	.5741	1.0000				
.2027	-.1341	-.0074	-.1018	-.2626	-.1034	-.0263	-.0441	-.0024	-.0490	-.0121	1.0000			
-.1308	.3337	.2954	.3175	.1227	.1821	.2619	.0740	-.0647	.0618	.1316	.0749	1.0000		
.7660	-.1621	-.2604	-.6901	-.7318	-.4799	.0689	-.0774	.0047	-.0223	-.1703	.1752	-.1552	1.0000	
.1809	-.0912	.0210	-.1507	-.1071	-.4259	.0058	.0504	-.0361	.0019	-.0065	.0265	-.2310	.1036	1.0000
-.1456	.0935	-.0267	.0935	.1113	.0651	.0769	-.0914	-.0611	-.0046	-.0033	-.0368	.0209	-.0936	-.4950
.0216	.0010	.1107	-.0462	.0198	-.0091	.0006	.0380	.0737	-.0006	-.0023	.0327	-.0206	-.0207	-.0012
-.0166	.0048	.0204	.0165	.0219	.0133	.0119	.0549	-.0820	-.0320	-.0022	-.0372	-.0066	-.0012	
.0164	.1942	.1407	.1374	-.0429	-.0212	.1026	-.0925	.0376	-.0171	-.0259	.1256	-.0425	.0054	-.0020
.0424	-.0167	.0094	-.0505	-.0124	-.1335	-.0232	-.0230	-.0272	-.0070	-.0054	-.0052	-.0661	-.0007	.1860
-.1700	-.1408	-.2430	.0176	.1066	.0735	-.2358	.0619	.0620	.0659	-.0471	-.3739	-.1018	-.1630	-.0003
-.3442	.0694	.0074	.3192	.2766	.2318	-.0411	.0614	-.1062	.0067	.1009	.5423	.0709	-.2737	-.0972
-.2670	.0537	.0905	.2480	.2996	.1649	-.0093	.0911	.0539	.0555	.0801	-.1470	.0330	-.1937	-.0469
-.2190	.0193	.0746	.1249	.2713	.1152	-.0737	.0556	.0710	-.0237	-.1532	-.1172	-.0311	-.1750	-.0750
.0417	-.0109	-.0410	.0360	.0032	-.0051	-.0245	.0407	-.1250	-.0344	.0007	-.0451	.0342	-.0330	-.0001
.0562	-.0331	-.0619	-.0450	-.0616	-.1245	-.0254	.0308	.0024	-.0195	-.0016	-.0500	-.0371	.0267	-.0001
.0540	-.0640	-.0217	-.0262	-.1154	-.3007	.0206	.0369	-.0739	.0233	.0373	.0040	-.1419	.0559	.5016

CORRELATION MATRIX

EX8	EX9	EX0	EX1	STR	ZA	WB	SAT	SHD	ANT	ANTLI	XCANFA
1.0000											
-.4525	1.0000										
-.0002	-.4863	1.0000									
-.0019	-.0015	-.6367	1.0000								
-.0717	-.0001	-.0001	-.0013	1.0000							
-.0002	-.0002	-.0002	-.0023	.0872	1.0000						
.0227	-.0110	.0241	.0069	-.0121	.0486	1.0000					
.0498	-.0226	.0108	-.0107	-.0231	.0636	-.4042	1.0000				
.0063	.0642	-.0180	-.0155	.0278	.0719	-.6317	-.1289	1.0000			
-.0001	-.0001	-.0001	-.0008	-.0001	.1580	.1851	.0095	-.1809	1.0000		
-.0001	-.0001	-.0001	-.0008	-.0001	.1759	-.0603	-.0918	.1135	-.1159	1.0000	
-.1695	-.0357	-.0279	.0027	-.6081	-.0294	.1563	-.0680	-.1664	.0175	.0370	1.0000

EQUATION 1 SCANPA

VARIABLE	LAMBDA(X) TYPE GROUP	COEFFICIENT	GRADIENT	STD-ERROR	STUDENT-T	ELAST(S) (OBS. NO.	ELAST(E) 13 - 178)	ELAST(S) (OBS. NO.	ELAST(E) 167 - 178)
1 FAD	EL 1	-.1671769E+02	-.6621179E-08	.2546910E+02	-.6564	-.1750	-.1745	-.3557	-.3575
2 NC	EL 1	-.6920459E-01	.1661264E-06	.8307898E-01	-.8230	-.4065	-.4052	-.9969	-1.0011
3 P	EL 1	.2791146E+00	.1250989E-07	.3548212E+00	.7866	.2939	.2930	.4290	.4312
4 RAMEN	EL 2	.6444647E+00	.5044069E-07	.2451286E+01	.2629	.6473	.6453	.7399	.7437
5 TV	EL 3	-.6373211E+00	.7118151E-08	.1872692E+01	-.3750	-.0197	-.0197	-.0137	-.0134
6 TT	EL 3	-.5520252E+01	.5344903E-08	.5601515E+01	-.9716	-.5777	-.5759	-.7826	-.7867
7 Y2Y	EL 3	.3369822E+00	.1210410E-10	.4196077E+00	.8031	.1738	.1733	.1356	.1362
8 TLK	NL 0	-.2218628E-02	.3202632E-07	.8046039E-02	-.2757	-.0022	-.0022	-.0024	-.0024
9 RPK	NL 0	-.2284748E-01	.7646875E-08	.9061187E-02	-2.5215	-.0083	-.0083	-.0075	-.0075
10 SFK	NL 0	.2221398E-03	.8203594E-07	.1194369E-02	.1860	.0003	.0003	.0005	.0005
11 USFMR	NL 0	.3908020E-02	.6718346E-07	.2577175E-02	1.5164	.0050	.0050	.0074	.0075
12 LANP	EL 4	.3200358E+00	.1523257E-08	.7576080E-01	4.2243	.2361	.2353	.2268	.2260
13 RLUP	NL 0	.2143225E-02	.6017078E-07	.1095420E-01	.1957	.0025	.0025	.0050	.0050
14 PHUNF	EL 4	.2582027E-01	.2179726E-07	.3269567E-01	.7849	.0545	.0549	.0847	.0718
15 EX7	NL 0	.2488219E+00	-.2284517E-08	.3736569E-01	6.6591	.0139	.0139	0.0000	0.0000
16 EX8	NL 0	.1865308E-01	.9456016E-08	.5835845E-02	3.1963	.0024	.0023	0.0000	0.0000
17 E49	NL 0	.1075351E-01	.2427792E-08	.7247724E-02	1.4833	.0008	.0008	0.0000	0.0000
18 L40	NL 0	-.1935824E-02	.2911520E-08	.1164477E-01	-.1662	-.0001	-.0001	0.0000	0.0000
19 L41	NL 0	-.1892797E-02	.1312860E-07	.1709959E-01	-.1107	-.0001	-.0001	-.0016	-.0016
20 LTR	NL 0	-.7194243E+00	.5411493E-10	.6418778E-01	-11.2081	-.0097	-.0097	0.0000	0.0000
21 ZA	NL 0	.8974337E-01	.2005748E-08	.2477233E-01	3.6227	.0217	.0216	0.0000	0.0000
22 WD	EL 5	.1667474E+01	.9551279E-08	.1357009E+01	1.2208	.6612	.6591	.7035	.7071
23 SAT	EL 5	.2730764E+00	.1675003E-07	.4586012E+00	.5955	.0345	.0342	.0899	.0904
24 SHD	EL 5	.2721470E+00	.1854859E-07	.4940479E+00	.5509	.0789	.0786	.0840	.0844
25 ANT	NL 0	-.0841006E-01	.1942928E-09	.5426252E-01	-1.6353	-.0003	-.0003	0.0000	0.0000
26 ANTL1	NL 0	.4070684E-01	-.9595153E-10	.3122593E-01	1.3036	.0001	.0001	0.0000	0.0000
27 CONSTANT	NL 0	-.7837907E+01	.1452026E-07	.8745943E+01	-.8962	-3.9830	-3.9766	-4.2383	-4.2601

AUTOCORRELATION

28 RHO 1	.1812165E+00	-.1212153E-04	.7904125E-01	2.2927
29 RHO 12	.7288579E+00	-.1899380E-04	.7639170E-01	9.5411

B04-LOE ON (X)

30 LAMBDA(X) 1	.2156880E+01	-.1438047E-05	.8872182E+00	2.4421 1.2098
31 LAMBDA(X) 2	.3291072E+00	.6442917E-06	.1777459E+01	.18.7 -.3774
32 LAMBDA(X) 3	-.2072210E+01	.5052568E-07	.1260646E+01	-1.6419 -2.4370
33 LAMBDA(X) 4	.1763708E+01	.1427568E-06	.1053236E+01	1.6746 .7251
34 LAMBDA(X) 5	-.3381668E+00	-.2063089E-06	.1181217E+01	-.2917 -1.1624
BOY-COX ON (Y)				
35 LAMBDA(Y)	.9604979E+00	.4268077E-05	.1582521E+00	6.0694 -.2496
HETEROSKEDASTICITY				
36 DELTA 1	.7080802E+00	.7720158E-06	.2392344E+01	.2947
37 LAMBDA(E) 1	-.7233265E+00	.4120407E-06	.5772950E+01	-.1257 -.2985
RESIDUAL (W)				
38 ERROR VARIANCE	.9193828E-03	.1983790E-07	.6137188E-03	1.4981
LOG-LIKELIHOOD				
- INITIAL VALUE :	265.4020440			
- FINAL VALUE :	308.8090254			
- RATIO TEST :	86.9739630			
PSEUDO-(E)-R2 :	.9727879			
PSEUDO-(E)-R2 :	.9727346			
STD-ERROR OF (W) :	.0303213			
NUMBER OF OBSERVATIONS FIRST-LAST OBS.NO.				
- SAMPLE :	101	1 - 101		
- ESTIMATION :	166	13 - 178		
- PREDICTION :	3	179 - 181		

PREDICTION OF THE DEPENDENT VARIABLE FOR 3 PERIODS

	OBSERVED VALUE	SIMULATED VALUE	MAX. LIKELIHOOD PREDICTED VALUE	ERROR OF FORECAST IN %	STD-ERROR OF FORECAST	95% CONFIDENCE INTERVAL LOWER BOUND	INTERVAL UPPER BOUND
179	1.9272980	1.8989012	1.8988683	1.27	.0458748	1.8089554	1.9887813
180	2.0425560	1.9684975	1.9684574	3.63	.0506285	1.8692256	2.0676893
181	1.9541080	2.0189694	2.0189254	-3.32	.0605473	1.9002527	2.1375981

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